Test Equipment Depot
1-800-517-8431

User Manual

Tektronix

MTS400 Series
MPEG Test Systems

Volume 1 of 2

071-1507-01

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Glossary

General Safety Summary

Review the following safety precautions to avoid injury and prevent damage to this product or any products connected to it.

To avoid potential hazards, use this product only as specified.

Only qualified personnel should perform service procedures.

To Avoid Fire or Personal Injury

Use Proper Power Cord. Use only the power cord specified for this product and certified for the country of use.

Ground the Product. This product is grounded through the grounding conductor of the power cord. To avoid electric shock, the grounding conductor must be connected to earth ground. Before making connections to the input or output terminals of the product, ensure that the product is properly grounded.

Observe All Terminal Ratings. To avoid fire or shock hazard, observe all ratings and markings on the product. Consult the product manual for further ratings information before making connections to the product.

Power Disconnect. The power cord disconnects the product from the power source. Do not block the power cord; it must remain accessible to the user at all times.

Do Not Operate Without Covers. Do not operate this product with covers or panels removed.

Do Not Operate With Suspected Failures. If you suspect there is damage to this product, have it inspected by qualified service personnel.

Avoid Exposed Circuitry. Do not touch exposed connections and components when power is present.

Use Proper Fuse. Use only the fuse type and rating specified for this product.

Do Not Operate in Wet/Damp Conditions.

Do Not Operate in an Explosive Atmosphere.

Keep Product Surfaces Clean and Dry.

Provide Proper Ventilation. Refer to the manual's installation instructions for details on installing the product so it has proper ventilation.

Terms in this Manual

These terms may appear in this manual:

WARNING. *Warning statements identify conditions or practices that could result in injury or loss of life.*

CAUTION. *Caution statements identify conditions or practices that could result in damage to this product or other property.*

Symbols and Terms on the Product

These terms may appear on the product:

- DANGER indicates an injury hazard immediately accessible as you read the marking.
- WARNING indicates an injury hazard not immediately accessible as you read the marking.
- CAUTION indicates a hazard to property including the product.

The following symbols may appear on the product:

CAUTION
Refer to Manual

Protective Ground
(Earth) Terminal

Service Safety Summary

Only qualified personnel should perform service procedures. Read this *Service Safety Summary* and the *General Safety Summary* before performing any service procedures.

Do Not Service Alone. Do not perform internal service or adjustments of this product unless another person capable of rendering first aid and resuscitation is present.

Disconnect Power. To avoid electric shock, switch off the instrument power, then disconnect the power cord from the mains power.

Use Care When Servicing With Power On. Dangerous voltages or currents may exist in this product. Disconnect power, remove battery (if applicable), and disconnect test leads before removing protective panels, soldering, or replacing components.

To avoid electric shock, do not touch exposed connections.

Preface

This manual describes the functions and use of the MTS400 Series MPEG Test System. After the introduction, each section of the manual describes one of the software applications or tools that make up the MTS400 Series system.

- *MTS400 Series MPEG Test System Getting Started Manual* (071-1505-xx).
- *MTS400 Series MPEG Test System Programmer Manual* (071-1725-xx). This manual specifies the remote control and status monitoring interfaces available to a management application.

Related Material

Additional documentation, such as Read Me files, may be included on the installation disks.

The following URLs access the Web sites for the standards organizations listed (the URLs listed were valid at the time of writing):

- MPEG-2 standards (International Organization for Standards) http://www.iso.ch/
- DVB standards (European Technical Standards Institute) http://www.etsi.org/
- ATSC standards (Advanced Television Systems Committee) http://www.atsc.org/
- ISDB/ARIB standards (Association of Radio Industries and Businesses) http://www.arib.or.jp/english/
- SCTE Society of Cable Television Engineers http://www.scte.org/

Manual Conventions

Naming conventions for the interface elements are based on standard Microsoft Windows naming conventions. Naming conventions for MPEG-2, ATSC, and DVB structures follow the conventions derived from the standards listed above. In addition, the following formatting conventions apply to this manual:

- **Bold** text refers to specific interface elements that you are instructed to select, click, or clear.
  Example: Select **Settings** from the Configuration menu.
- Mono-spaced text can indicate the following:
  - Text you enter from a keyboard
    Example: Enter the network identity (`http://TSMonitor01`)
  - Characters you press on your keyboard
    Example: Press CTRL+C to copy the selected text.
  - Paths to components on your hard drive
    Example: The program files are installed at the following location:
    `C:\Program Files\Tektronix\`

Introduction

MTS400 Series Software Applications

Table 1–1 summarizes the software applications that make up the MTS400 Series MPEG Test Systems. Options are enabled by a software key; not all options may be enabled. Detailed descriptions of all applications can be found in the remainder of this manual.

See also the *MTS400 Series MPEG Test Systems Getting Started manual* (071-1507-xx).

The MTS4EA Compressed Video ES Analyzer options are described in the *MTS4EA User Manual* (071-1641-xx).

(The applications are shown in the same order that they appear in the Windows Start menu.)

Table 1-1: MTS430 / MTS400 / MTS4SA / MTS4UP Installed Applications

Application	Desktop Icon (where installaed)
Analyzers	
Transport Stream Compliance Analyzer (TSCA) - Real Time Real-time transport stream analysis with user-selectable MPEG-2, DVB, ATSC and ISDB conformance tests. Shows transport structure, header contents, hexadecimal packet contents, PCR timing /transport rate graphs and error message logs.	
Transport Stream Compliance Analyzer (TSCA) - Deferred D.eferred transport stream analysis with user-selectable MPEG-2, DVB, ATSC and ISDB conformance tests. Shows transport structure, header contents, hexadecimal packet contents, PCR timing /transport rate graphs and error message logs.	
Transport Stream Compliance Analyzer Lite (TSCA) - Deferred Same as for the TS Analyzer except that the file size of transport streams to be analyzed is limited to 192 MB.	
Packetized Elementary Stream (PES) Analyzer PES analysis with selectable test options. Shows PES program structure, header contents, packet contents, PTS/DTS timing graphs and analysis reports.	
Transport Stream - System Target Decoder (T-STD) Buffer Analyzer Analyzes program streams modeling their behavior in, and their conformance to, the MPEG 2 T STD Buffer Model.	

Table 1-1: MTS430 / MTS400 / MTS4SA / MTS4UP Installed Applications (Cont.)

Application	Desktop Icon (where installaed)
Elementary Stream Analyzer Elementary Stream analysis at video picture and audio level. This includes vector graphs and macroblock picture quality.	
Carousel Analyzer Data analysis showing structure, bit rate, repetition rate, syntax and semantics of data items.	
Generators	
Carousel Generator Provides in-depth off-line generation of MPEG-2, DVB transport streams containing a range of data broadcast protocols.	
Multiplexer Multiplexes table information and packetized elementary streams together to synthesize new transport streams. A fine level of control is provided to allow non-conformances and test cases to be specified for new transport streams.	
TS Editor Viewing and Editing of transport stream packets, using a hexadecimal view of the packet contents and semantic interpretation of the header. Provides facilities to remap PIDs, recalculate PCR values, and introduce PCR inaccuracies.	
Players	
MPEG Player Records and Plays out MPEG-2 streams.	
Utilities	
Tracer Views the message log produced by T-STD Buffer Analyzer.	
Make Seamless Wizard Guides the user through the process of creating an MPEG-2 file for use by Stream Player in continuously looped operation.	

Table 1-1: MTS430 / MTS400 / MTS4SA / MTS4UP Installed Applications (Cont.)

Application	Desktop Icon (where installaed)
Stream Cutter Extracts sections of MPEG-2 files to new files.	
Script Pad Enables users to create and modify System Information (SI) scripts.	

Transport Stream Compliance Analyzer

Getting Started

The MTS400 MPEG Transport Stream Compliance Analyzer (TSCA) enables you to monitor and interpret the contents of real-time or previously recorded or synthesized transport streams using the latest MPEG, DVB, ATSC, ISDB-T, and ISDB-S standards.

The TSCA is specifically designed to enable you to quickly locate and identify problems within a transport stream using a minimum number of mouse clicks. By quickly identifying the problem areas, the TSCA software helps you save time during the development and test of equipment, networks, and services. You can configure the TSCA software to display stream information in user-selected fonts. This feature enables you to view stream information in your local language or to use custom fonts.

The TSCA software will run stand-alone on computers with Microsoft Windows NT 4.0, Windows 2000, or Windows XP operating systems.

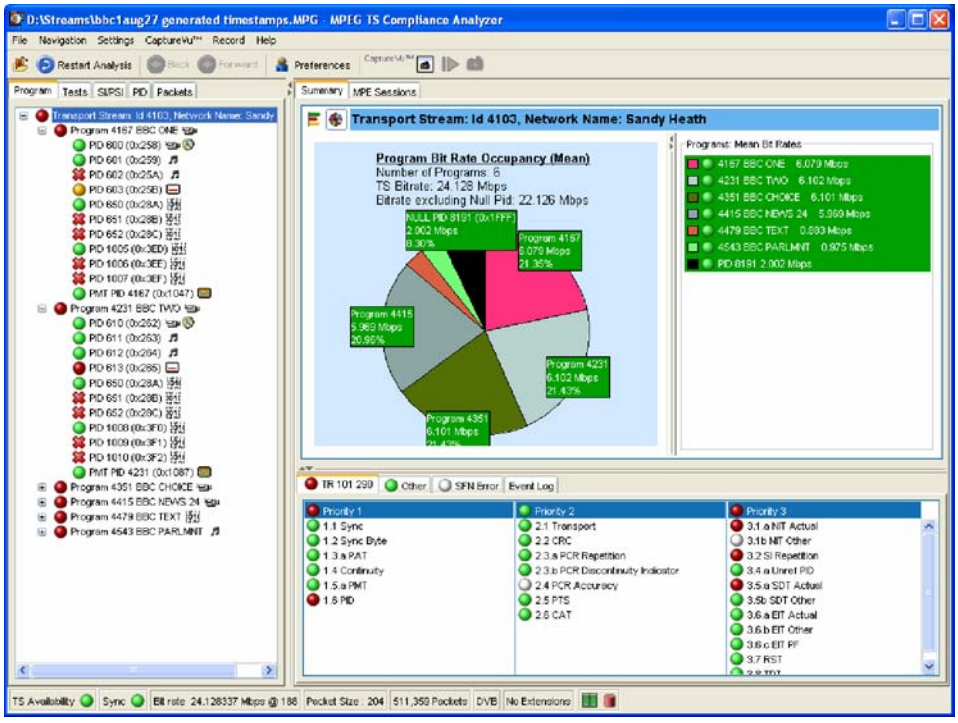


Figure 2-1: TSCA Program View - Deferred Analysis

TSCA Features

- Easy “program centric” user interface quickly isolates information of interest
- CaptureVu™ technology captures and analyzes system events in real or deferred time
- In-depth analysis of stored transport streams including support for MPEG, ATSC, DVB, ISDB-T and ISDB-S table types
- Data summaries and automated filters simplify the analysis of complex transport streams
- TR 101 290 Priority 1, 2 and 3 tests
(European Telecommunications Standards Institute (ETSI) TR 101 290: Digital Video Broadcasting (DVB); Measurement Guidelines for DVB Systems.)
- Syntax analysis and display supported for TMCC and IIP data
- Consistency checks performed between SI, TMCC, and IIP data
- Proprietary PSI/SI syntax section rate error testing
- Error logging
- Suspension of all tests at program changeover based on PMT version change
- DII and DDB error checking

Deferred and Real-Time Modes

The TSCA can be run in deferred or real-time mode. Deferred mode is available on any recommended platform (including users’ own PCs). In deferred mode a static stream can be analyzed and displayed; the content can then be inspected at leisure. Real-time streams can be paused for detailed offline analysis and then when the issue has been found, real-time analysis can be resumed. In real-time mode, a “live” stream is analyzed and displayed and is available when the TSCA is installed on a MTS400 series MPEG Test System with any supported physical layer interface. Real-time monitoring of Video over IP (internet protocol) is also available as a standalone application for running on a user’s own PC.

Technical Background

The analyzer has a client-server architecture. Each invocation of the analyzer starts up two processes: tsca.exe, which is the client, and MpegCore.exe, which is the MPEG analysis engine. Additionally, with the first invocation of the analyzer, another single process, CoreManager.exe, is started. CoreManager.exe forms an intermediary between TSCA clients and MPEG cores.

The tsca.exe, MpegCore.exe and CoreManager.exe processes use SNMP (Simple Network Management Protocol) and HTTP (Hypertext Transfer Protocol) to communicate. The port numbers used for communication are read from a configuration file, CoreInfo.xml. In a default installation, this file can be found in c:\program files\tektronix\mpeg\mts400\apps\tsca\xml\. The default port range is 15700-15800. These values can be changed if they clash with other applications.

On the MTS400 platform, another process, mint.exe, runs from system startup. This process controls shared access to the MTS400 Series hardware by the analyzer and player.

You must have local administrator rights on the MTS400 unit or your PC to be able to use IP analysis. If you need to change your rights on either the MTS400 or your PC, please consult your system administrator.

User Interface

The TSCA software uses a single main program summary window with different context sensitive views contained within tabbed frames. This provides the maximum amount of useful information while keeping the screen from appearing cluttered. From the main window, you can access the following views:

Program View

The Program view provides a fast overview of the transport stream contents in terms of program content, bit rate use by each program, and TR 101 290 test results. Red, amber and green LEDs highlight errors associated with each program, or element of a program, within the transport stream. Red LEDs indicate that there are current errors in the stream, amber LEDs indicate that errors have occurred but are now clear, and green LEDs indicate that no errors have been detected.

Errors that are detected at lower levels in the program stream hierarchy propagate up to the highest level. This allows you to monitor all of the programs in the stream at a high level and then quickly go to lower levels as necessary to locate a problem.

Tests View

The Tests view enables you to isolate errors to the specific tests that have been applied to the transport stream. The error log is automatically filtered by the selected test, and can also be filtered by Packet Identifier (PID). In addition to the standard first, second, and third priority tests included in TR 101 290 standard, tests are available for Program Clock Reference (PCR) jitter and program/PID bit rate. A variability test enables you to test the changes in the bit rate of a specific PID, and there are many tests that are specific to ISDB-T and ISDB-S streams.

SI/PSI (Tables) View

The SI/PSI (Tables) view displays the service information tables that have occurred in the analyzed stream which comply with the selected digital video standard. This includes MPEG specific program information, DVB service information, and ATSC and ISDB program and system protocol information. The tables are grouped together by function and hyperlinks enable you to quickly access related information within other tables.

PID View

The PID view displays information about all of the PIDs found in the transport stream. When you select a PID, the associated summary view provides a PID-oriented overview of the transport stream, displaying the relative data rates of all of the PIDs contained within the stream. The information can be displayed as either a bar chart or as a pie chart. Pop up menus enable fast limit selection.

Each PID is associated with a number of tests. When one or more tests fail, each failed test will be listed under the relevant PID. Select a specific PID to display a summary of all the associated tests. Select a specific test to display the Event Log and Parameters for that test only.

Packets View

The Packets view displays information about all of the packets found in the transport stream grouped according to content. These groups include PID value, SFN mega-initialization packets (MIPs) (DVB only), and ISDB-T information packets (IIPs). When you select a specific PID or MIP, only packets carrying that particular PID or MIP are displayed. A section view is also available.

The Packets view is not available in real-time mode. However, packets in a real-time stream can be examined using the Capture-Vu feature.

Capture Vu™ Feature

The CaptureVu™ feature captures a snapshot of system events in real and deferred time and allows you to debug the intermittent and complex problems that traditional analyzers miss. You can initiate CaptureVu either manually or automatically by associating a CaptureVu Breakpoint with any test event. When a breakpoint is detected, either manual or automatic, the stream is paused and an in-depth deferred time analysis can be performed on stored data. This powerful debug mode enables fast debugging of troublesome intermittent problems.

Triggered Recording

During real-time analysis, stream information can only be held for a finite time - eventually it will be overwritten by more up-to-date information. Triggered recording allows a portion of a stream to be recorded and subsequently analyzed in detail.

The following trigger sources and conditions apply:

- Any test event
- External input; (TTL) edge specifiable
- Date and time
- Recorded file size can be specified
- Pretrigger buffer size can be specified as a percentage of the overall file size range from 0 – 100%.

Starting the TSCA Software

The TSCA can analyze either transport streams in real-time or off-line (deferred) mode.

Opening the TSCA

From the Windows Desktop, select **Start > Programs > Tektronix MTS400 > Analyzers > TS Compliance Analyzer**.

The TSCA is opened, initially overlaid with the **Open Transport Stream...** dialog box.

Click Analyze File to select the transport stream file to analyze and to select the method for calculating the rate of the stream.

Click Real-time Analysis to select an input source (IP or hardware interface) for real-time analysis.

Click Stream Interpretation to select which standards will be used to interpret the stream file.

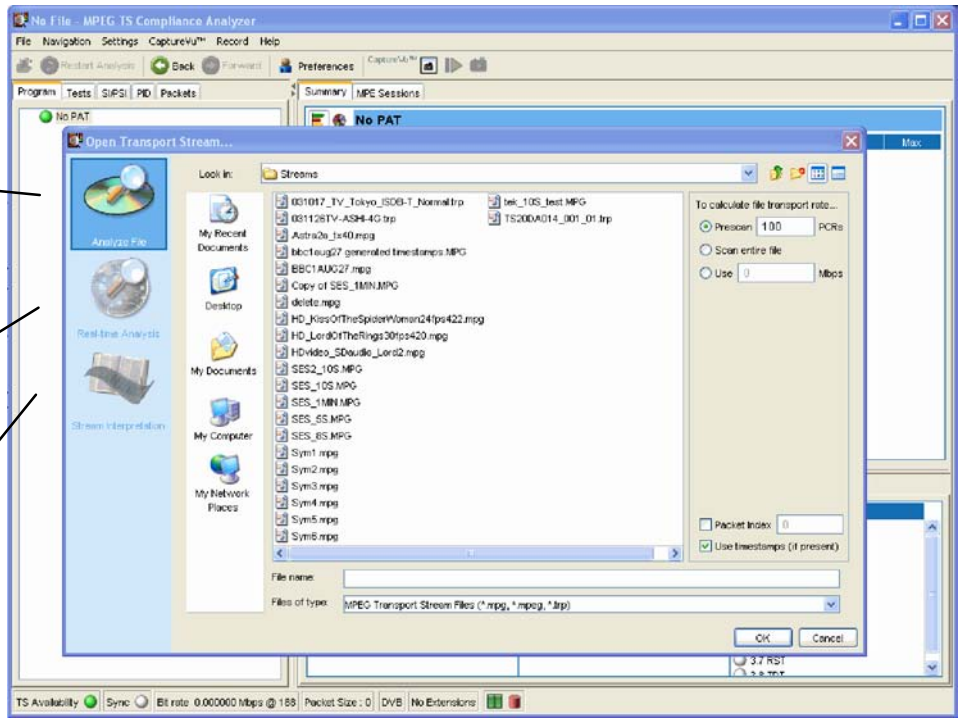


Figure 2-2: TSCA Start-up

The **Open Transport Stream...** dialog box allows you to:

- Select the interpretation standard to be used for analysis.
  (The stream interpretation should be checked and, if necessary, set first.)
- Identify a stream file for off-line analysis.
- Identify an MTS400 input (IP, ASI or SMPTE or DVB Parallel) receiving a stream and start real-time analysis.

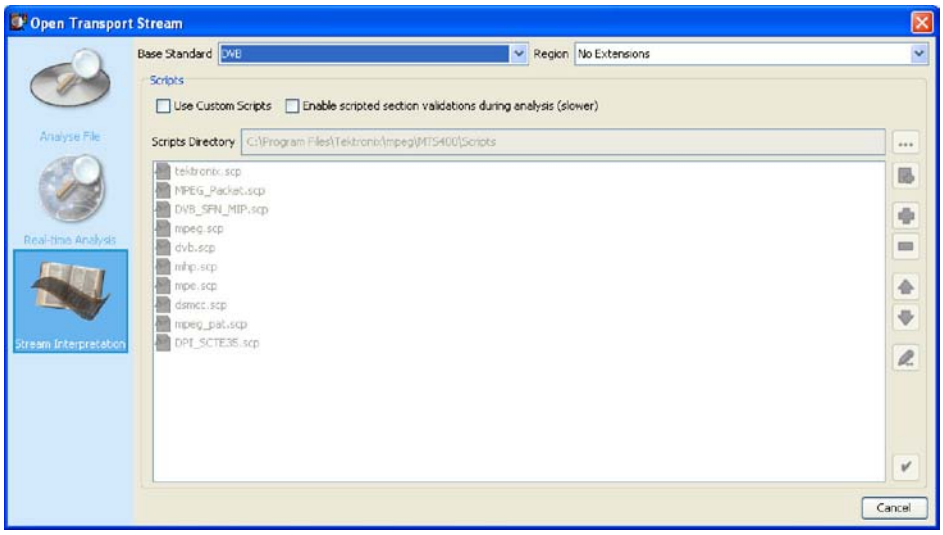
Stream Interpretation

1. Click **Stream Interpretation** at the left of the Open Transport Stream window to select which standards will be used to interpret the stream.

***NOTE**. The TSCA software analyzes streams in strict accordance with the standards defined by the digital television authorities: DVB (Digital Video Broadcasting), ATSC (Advanced Television Systems Committee), and ISDB (Integrated Services Digital Broadcasting).*

The TSCA software uses preloaded scripts which establish the expected content and syntax of the analyzed stream. The analyzer is supplied with a comprehensive range of scripts, which, in different combinations, can interpret the full range of digital television standards.

2. Select the **Base Standards** and then (if available) select the **Region**. The analysis scripts that will be used are displayed in the Script Files pane.



3. The stream interpretation is now set. Choose one of the analysis options to select a file or real-time analysis.

***NOTE**. The selected stream interpretation standard is not implemented until stream analysis is started. If the Open Transport Stream dialog box is closed without starting analysis, the stream interpretation settings are lost; they revert to the settings that were in effect when the application was last closed.*

Off-Line (Deferred) Analysis

Perform the following steps to start analyzing a transport stream file:

4. In the Open Transport Stream dialog box, with Analyze File selected, use the drop-down box at the top of the window to browse to a transport stream file. When you select a stream, the stream name appears in the field at the bottom of the window.

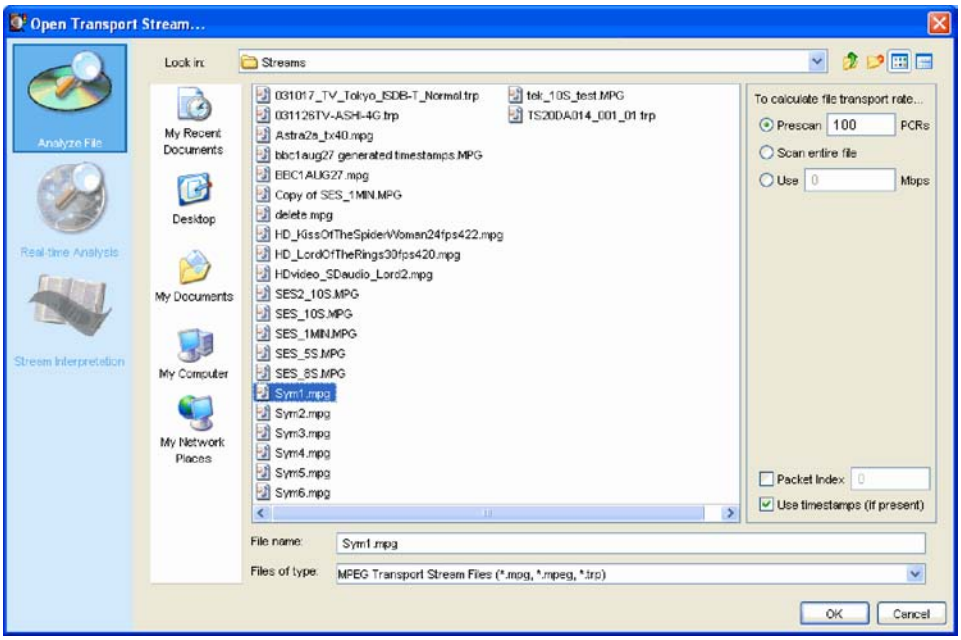


Figure 2-3: TSCA File Analysis (Offline) dialog box

Calculating the Transport Rate. To analyze a transport stream correctly, you must do one of the following:

- Calculate the bit rate from PCRs (Program Clock Reference) carried in the stream

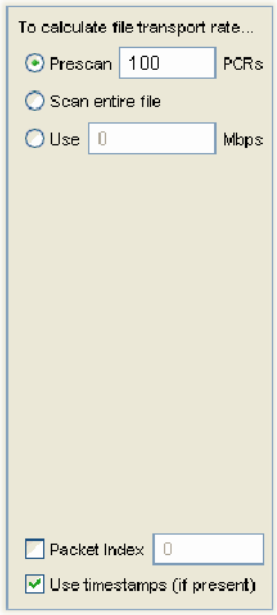
---

***NOTE**. When the TSCA software analyzes a transport stream, it compares the bit rate of the stream to the expected rate. Errors are reported based on the expected rate of the stream. To analyze a stream correctly, it is necessary to know the original bit rate of the stream or to calculate the bit rate from PCRs (Program Clock Reference) carried in the stream. PCRs are generated as a stable clock reference and are added to the stream during its generation. During analysis, the PCRs are extracted and synchronized with a local clock reference.*

- Know the original bit rate and enter it manually
- Use timestamps included with the stream

5. After you select the desired stream, select one of the following methods for calculating the rate of the transport stream:

   - Prescan nnn PCRs. When you select this method, the TSCA software calculates the rate of the stream by prescanning the stream for embedded PCRs. The entry box lists the number of PCRs that the TSCA software recommends are necessary to determine the stream rate. You can use the entry box to enter a different number.
   - Scan Entire Files. When you select this method, the TSCA software calculates the rate of the stream by prescanning the stream for all of the embedded PCRs.
   - Use nnnn Mbps. When you select this method, the TSCA software uses the absolute value (in Mbps) that you enter as the expected stream rate.



   - Packet Index. The file will be analyzed up to the packet index entered. Leave this field blank to analyze the whole file.

***NOTE**. Timestamps, which are added when the stream is generated, will be used, if present, and if the Use Timestamps checkbox is enabled. Using timestamps will override the PCR options (Prescan PCRs and Scan entire file). The manual bit rate setting will override both PCRs and timestamps.*

6. If the TSCA software cannot calculate the bit rate from the embedded PCRs, or timestamps, a message box is displayed. You must enter an estimated bit rate before the TSCA software can analyze the stream.

With a file selected and the transport rate calculation set up, you can start the analysis (see page 2–11).

Real Time Analysis

Perform the following steps to start analyzing a transport stream received via IP or a hardware interface.

In the Open Transport Stream dialog box, with Real-time Analysis selected, select an interface from the drop-down list.

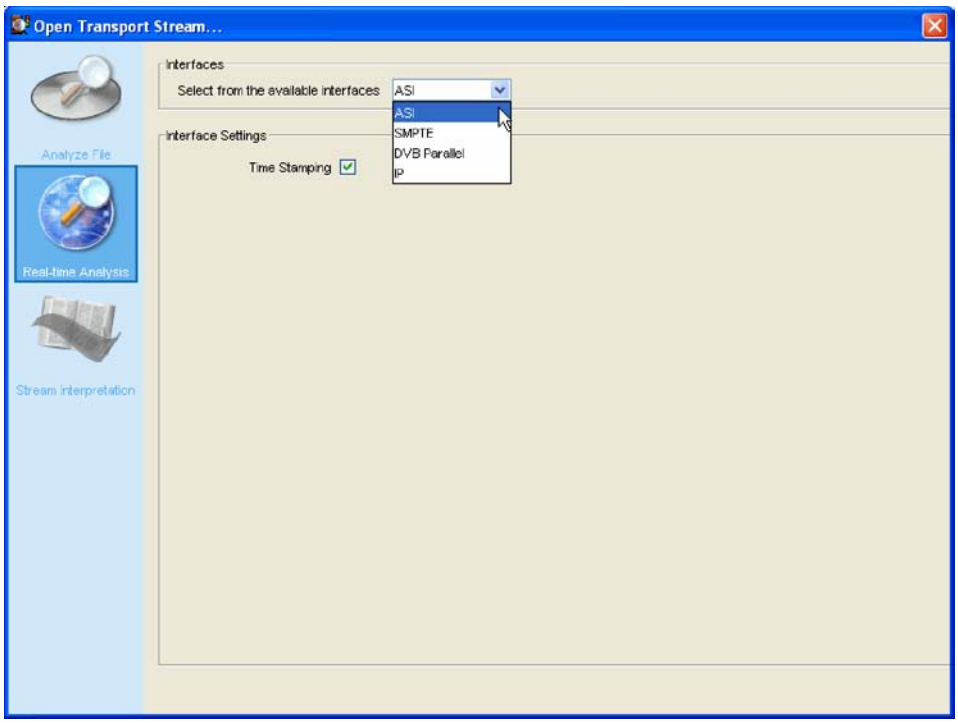


Figure 2-4: TSCA File Analysis (Real-time) dialog box

Real-time analysis will not be available if the appropriate software key permissions are not found. A warning message is displayed when real-time analysis is not available.

Make any necessary interface settings. During analysis, the interface selected will be shown in the status bar.
(The IP interface settings are described on page 2–12.)

Start the Analysis

1. After you have selected the interpretation standard and the stream source, click OK to continue.
2. The TSCA software starts analyzing the selected stream. During deferred analysis, a progress bar is displayed. The TSCA starts reporting analysis results (see Figure 2–5).

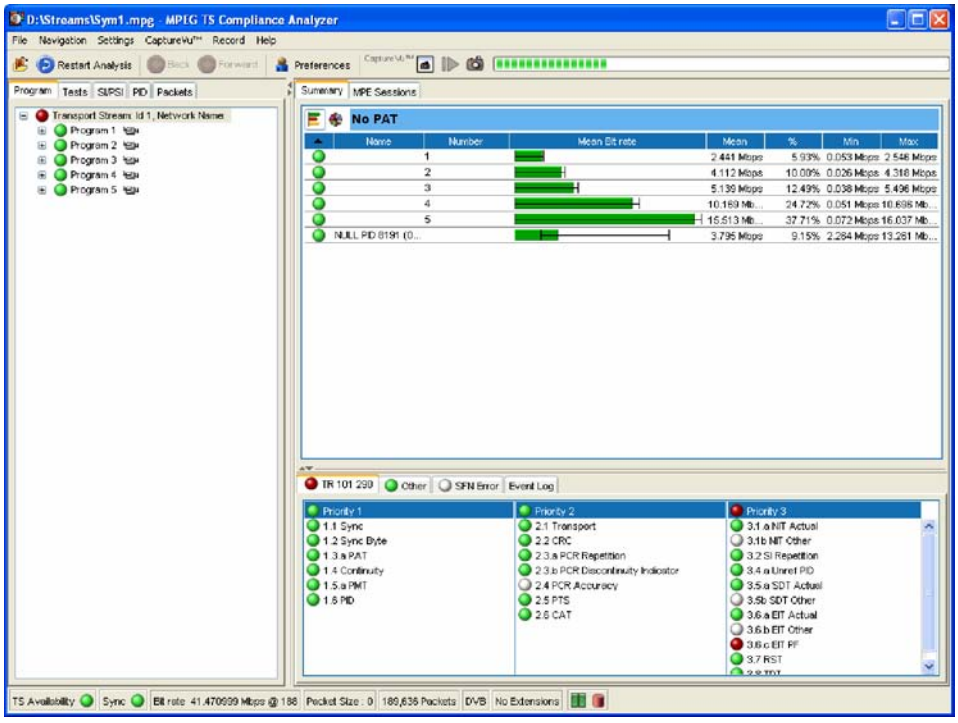


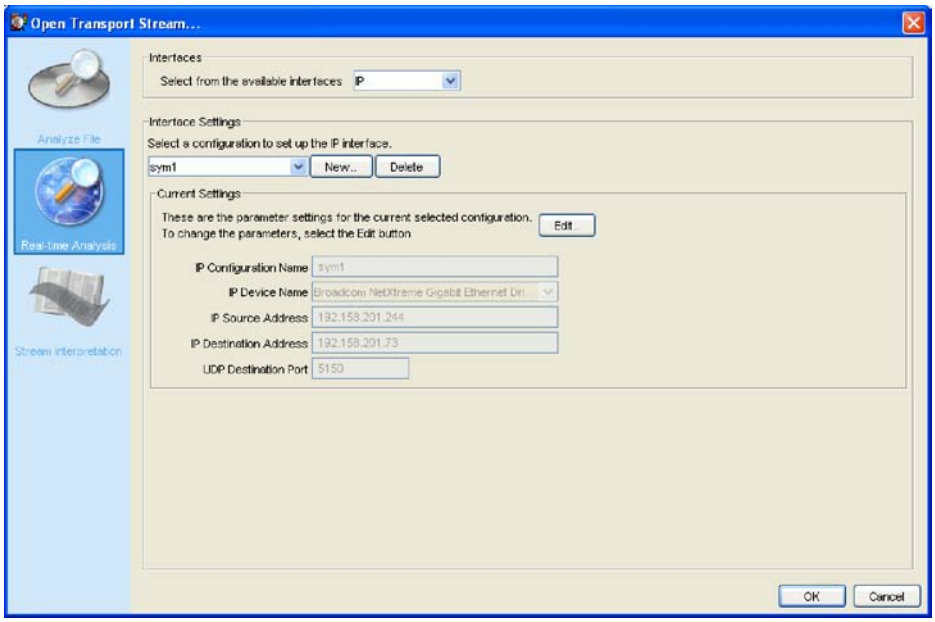
Figure 2-5: TSCA window showing analysis progress

3. When sufficient data has been gathered and the display has stabilized, you can start using the TSCA to view the analysis.
4. To analyze another stream file or to reanalyze the current stream using different standards, use the File > Open Transport Stream menu selection.

Setting Up the IP Interface

Two Ethernet interfaces are fitted as standard on the MTS400 Series systems (one 10/100 Base T and one 10/100/1000 Base T GigE). These allow for basic detection and display of all UDP (User Datagram Protocol) traffic on a network. Extraction of an MPEG over IP stream is possible (if the licensed option is enabled).

- IP multicast addresses are indicated. Note that the TSCA will not automatically join a multicast group (see also *Multijoin Utility*, page 2–13).
- UDP streams carrying MPEG TS traffic are indicated.
- A selected UDP stream carrying TS traffic may be selected for analysis and recording, in a similar manner to any other physical interface.



In the Open Transport Stream… dialog box with IP selected in the Select Interface drop-down menu, the current settings for the selected configuration are shown; the individual settings are described in the following paragraphs.

Select OK to confirm the IP setting and start analysis.

Multijoin Utility

The real-time IP analysis capability can only analyze traffic that appears on the link. To analyze a multicast that is not currently available on the link, a utility is provided called multijoin. This joins the multicast, effectively causing the multicast traffic to be broadcast to the host machine.

The multijoin utility can be found in the following directory: "c\program files\tektronix\mpeg\mts400\utilities".
To run the multijoin utility, open a command prompt window and change to the directory in which multijoin is installed. Run multijoin.exe and provide the IP address of the multicast you wish to join. For example, to join a multicast on 239.20.30.40 the command line would be: "multijoin 239.20.30.40".

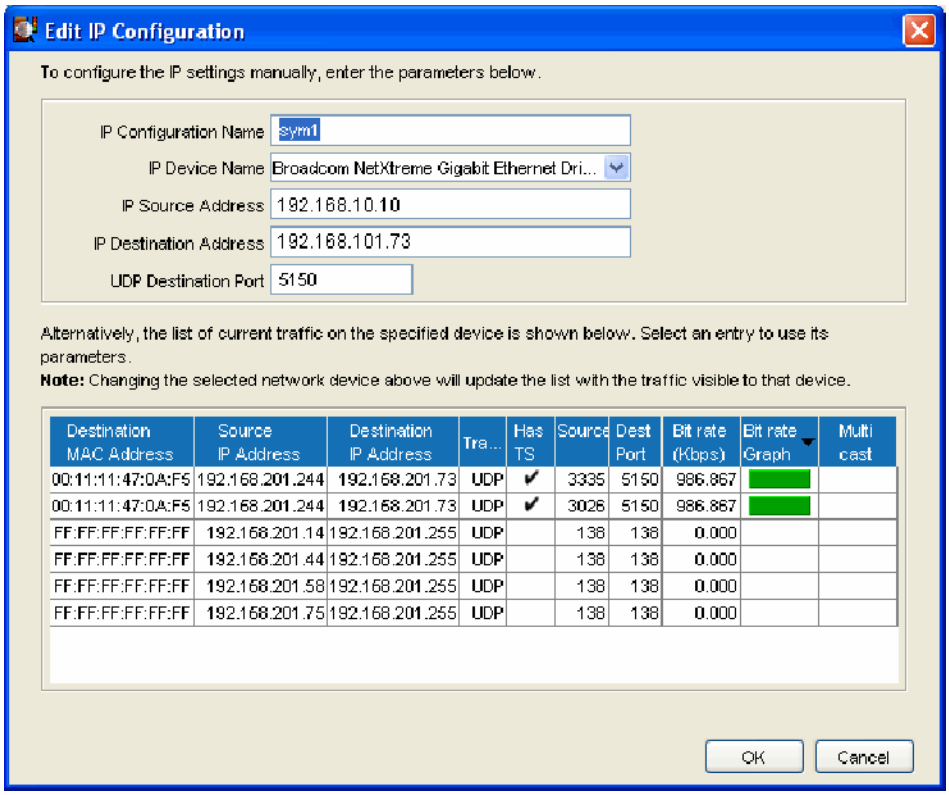
If the multicast can be joined successfully, the real-time IP analysis capability of the TSCA will be able to analyze the multicast traffic. While multijoin is running the mulicast traffic will be received; closing the program by typing Ctrl-C in the command prompt will close the multijoin program and quit the multicast group.

Interface Settings Configurations

You can save individual IP settings configurations to disk; they can be recalled when required. Up to 128 configurations can be specified.

The lower half of the Open Transport Stream… dialog box shows the settings associated with the currently selected configuration. The current settings are shown for information only; you cannot edit them in this dialog box. To change the settings, either create a new IP configuration, edit the current IP configuration, or select another IP configuration.

Create a New IP Configuration. Select New to open the Edit IP Configuration dialog box.


Edit IP Configuration
To configure the IP settings manually, enter the parameters below.
IP Configuration Name
sym1
IP Device Name
Broadcom NetXtreme Gigabit Ethernet Dri...
IP Source Address
192.168.10.10
IP Destination Address
192.168.101.73
UDP Destination Port
5150
Alternatively, the list of current traffic on the specified device is shown below. Select an entry to use its parameters.
Note: Changing the selected network device above will update the list with the traffic visible to that device.
Destination MAC Address
Source IP Address
Destination IP Address
Tra...
Has TS
Source
Dest Port
Bit rate (Kbps)
Bit rate Graph
Multi cast
00:11:11:47:0A:F5 192.168.201.244 192.168.201.73 UDP ✔ 3335 5150 986.867
00:11:11:47:0A:F5 192.168.201.244 192.168.201.73 UDP ✔ 3026 5150 986.867
FF:FF:FF:FF:FF:FF 192.168.201.14 192.168.201.255 UDP 138 138 0.000
FF:FF:FF:FF:FF:FF 192.168.201.44 192.168.201.255 UDP 138 138 0.000
FF:FF:FF:FF:FF:FF 192.168.201.58 192.168.201.255 UDP 138 138 0.000
FF:FF:FF:FF:FF:FF 192.168.201.75 192.168.201.255 UDP 138 138 0.000
OK
Cancel

A default configuration name is allocated and displayed in the IP Configuration Name field. You can enter a more meaningful name. This name and the settings associated with it will remain available for recall.

The names of any network devices installed in the unit (MTS400 or standalone) are displayed in the IP Device Name field. Select the network device required from the drop-down list. The traffic present on the selected interface is displayed in the bottom half of the dialog box.

The settings (IP addresses, UDP port) can be set up in two ways.

- Enter the values required in the IP and UDP fields.
- Highlight a session in the current traffic area; the values are entered in the IP and UDP fields automatically. Traffic carrying transport streams will have a check mark in the Has TS column.

When the settings are correct, select OK to confirm and save the configuration. The Edit IP Configuration dialog box is closed and the new configuration is immediately available in the Open Transport Stream dialog box.

Edit an Existing IP Configuration. An existing IP configuration can be modified as required.

Select Edit to open the Edit IP Configuration dialog box. Modify the individual fields or select a new entry in the traffic area. Select OK to confirm and save the changes and close the Edit IP Configuration dialog box. The new settings are implemented immediately.

Select an Alternative IP Connection. Select a new configuration from the Interface Settings drop-down list. Note the change in the Current Settings section of the window.

Delete an IP Configuration. To delete an IP configuration, ensure that the configuration to be deleted is displayed in the Open Transport Stream dialog box and select **Delete**. The selected IP configuration is deleted and the next available IP configuration is displayed.

Setting the Stream Content Font

You can configure the TSCA software to display stream content information in a user-defined font style or language, such as Japanese or Chinese.

***NOTE**. How the TSCA displays the text strings carried in the stream itself is dictated by the TSCA font setting and by the interpretation standard used during the analysis process.*

How the TSCA displays entries in the Event Log is dictated by the TSCA font setting and fonts used by a local computer. For example, if the default language of the TSCA computer is Japanese, the event log will be displayed in Japanese characters; you must choose a suitable font for the characters to display correctly.

Selecting the Display Font

Perform the following steps to set which font will be used by the TSCA software to display stream content. You can configure the TSCA software to display stream content using any font that is installed on your computer.

1. Select Settings > Preferences… from the menu.
2. Select Font at the left of the Preferences dialog box to display the window shown in Figure 2–6.

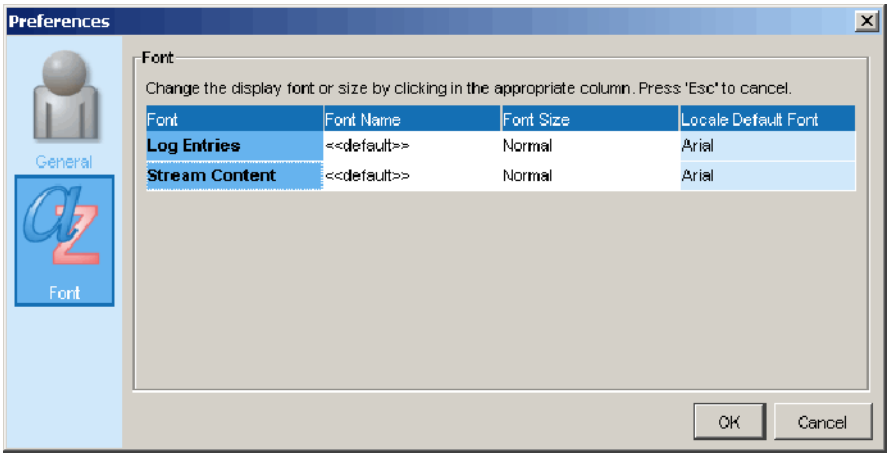


Figure 2- 6: Selecting a display font from the preferences dialog box

3. The dialog box lists the default font used by your computer for the Log Entries and Stream Content displays on the TSCA software. Use the Font Name and Font Size drop-down boxes to select a desired font style and size.
4. Click OK to accept and save any changes.

Installing Asian Language Fonts

Computers that are using local versions of MS Windows NT and MS Windows 2000 (such as Japanese or Chinese), or using MS Windows XP, should have the Asian language fonts already installed on their systems.

If your computer or MPEG test system does not have Asian fonts installed, perform the following steps to install the Asian fonts:

1. Insert the MS Windows OS CD-ROM, which was supplied with your computer or MPEG test system, into the CD-ROM drive.
2. Locate the LangPack directory on the CD-ROM. This directory contains a number of *.inf files for various languages. For example, you may want to install japanese.inf and/or tchinese.inf, for Japanese and Traditional Chinese language fonts.

3. To install new fonts, right click on each desired font file in the LangPack directory and select Install.

4. The new fonts you installed should now appear as possible font selections in the Preferences dialog box. You must select the new font in the Preferences dialog box before the new font will be used to display stream content.

Loading a Custom Extension Font

The ARIB specifications for the ISDB standards make use of private extensions to the standard Unicode character set [0xE000-0xF8FF]. These extensions allow a user to add additional characters and non-standard proprietary characters to an existing font. The extension sets are provided as TrueType Extension files (*.tte). Any extension sets should be installed using the Private Character Editor which is supplied as part of the standard MS Windows installation.

To install a font extension set on your computer:

1. Open the MS Windows Private Character Editor.

   a. Select Run from the Start menu.

   b. Enter eudcedit in the Run dialog box and click **OK**.

2. After the Private Character Editor opens, close the Select Code dialog box.

3. Select Font Links… from the File menu.

4. In the Font Links dialog box, select Link with Selected Fonts.

***NOTE**. If you select Link with All Fonts, the following actions will overwrite any existing font extension sets.*

---

5. In the Select Fonts box, find and highlight the font to which you are adding the extension. This font should be the one you selected in the TSCA font preferences dialog box.

6. After you select the font to which you are adding the extension, click on Save As….

7. In the Modify Private Character Filename dialog box, browse to the TrueType extension file you are adding (*.tte) and click Save.

8. In the Font Links dialog box, click OK.

9. Close the Private Character Editor window.

10. To verify that the font extension has been successfully installed, open the Character Map application.

    a. Select Run from the Start menu.

    b. Enter charmap in the Run dialog box and click OK.

11. Browse through the font list for the name of the font to which you added the extension. The term “Private Characters” should follow the font name. When you select the font name in the list, you can view the extended character set.

12. Close the Character Map application.

The new font extension you installed should now appear as a possible font selection in the Preferences dialog box. You must select the new font in the Preferences dialog box before the new font will be used to display stream content.

Understanding the Analyzer Window

On start up, the user can immediately open and analyze a transport stream (see *Starting the TSCA Software* on page 2–6). This will result in a display similar to that shown in Figure 2–7; this is the working display.

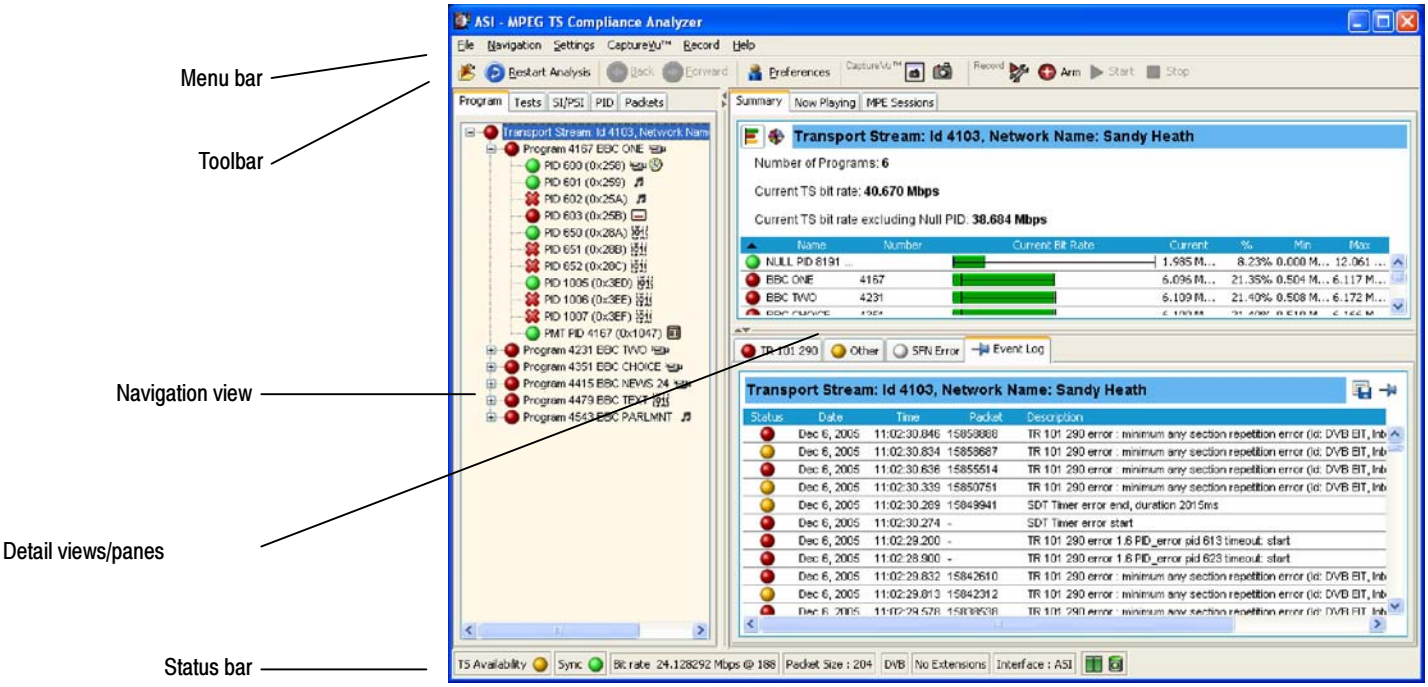

Menu bar
Toolbar
Navigation view
Detail views/panes
Status bar
ASI - MPEG TS Compliance Analyzer
File Navigation Settings CaptureVu™ Record Help
Restart Analysis Back Forward Preferences Record Arm Start Stop
Program Tests SI/PSI PID Packets
Summary Now Playing MPE Sessions
Transport Stream: Id 4103, Network Name: Sandy Heath
Number of Programs: 6
Current TS bit rate: 40.670 Mbps
Current TS bit rate excluding Null PID: 38.684 Mbps
Name Number Current Bit Rate Current % Min Max
NULL PID 8191
BBC ONE 4167
BBC TWO 4231
TR 101 290 Other SRN Error Event Log
Transport Stream: Id 4103, Network Name: Sandy Heath
Status Date Time Packet Description
TS Availability Sync Bit rate 24.128292 Mbps @ 188 Packet Size : 204 DVB No Extensions Interface : ASI

Figure 2-7: Analyzer window

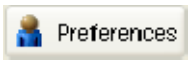
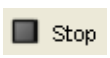
TSCA Window Components

The TSCA window contains the following components:

Menu Bar The Menu Bar provides access to a selection of system options using drop-down menus (see *Menu Bar and Options*, page 2–109).

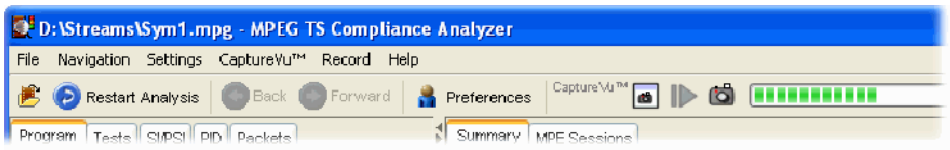
Tool Bar The buttons displayed on the tool bar provide shortcuts to often-used menu options. Additional buttons displayed during real-time analysis are shown in Table 2–1:

Table 2-1: Tool bar icons

Deferred and Realtime Analysis	
	Opens the Open Transport Stream dialog box.
	Restart analysis.
	User actions are recorded during a session. The forward and back buttons allow you to step through the actions in order to review or repeat them.
	Opens the Preferences dialog box from which you can set your preferences.
CaptureVu™	
	View CaptureVu status.
	Resume file analysis.
	Stop and capture analysis.
Realtime analysis	
	View record setting.
	Arm record feature.
	Start recording.
	Stop recording.

Progress bar

The progress bar indicates the progress of processing during deferred analysis of a stream.



To stop the analysis process, click the Stop button on the toolbar.

Navigation View

The left-hand pane in the main window is designated as the navigation view and provides the main analysis information for the transport stream in a number of forms: that is Programs, Tests, SI/PSI, PID and Packets. Views are selected using the tabs at the top of the pane. The background of each view is color-coded to aid identification.

Detail View/Panes(s)

The right-hand pane in the main window is the detail view and provides details related to the selection made in the current navigation view. The overall view may be subdivided into one or more panes; you can access individual views in multiple pane views using tabs.

Status Bar

The status bar, when not hidden, is displayed at the bottom of the main window and shows a summary of stream statistics.

The fields, from left to right, are as follows:

TS Availability: Indicates that either the stream bit rate has fallen below the minimum value or that synchronization has been lost (see also Sync below). The minimum stream bit rate is set using the “Min stream bit rate for processing” parameter, see *Parameter Edit*, page 2-81.

Sync: Shows the status of the MPEG sync loss test. Loss of sync during analysis of a stream may mean that analysis of the complete stream was not possible.

Bit rate: Total bit rate of the transport stream.
The packet value (188 or 204) is set using the Preferences feature (see page 2-112).

Packet Size: Packets in a stream can be either 188 or 204 bytes long. This is detected automatically.

Stream Interpretation, Base Standard:
This is the set of tests that are being used to analyze the stream.

Stream Interpretation, Region:
This subset of tests modifies the base standard; it may add tests or modify existing ones.

Physical Interface: The current interface for real-time analysis.

Partial Reception Availability:
Only available for ISDB-T streams. This icon indicates the presence of partial reception data in the stream. The colors indicate the status as follows:

Gray:	Partial reception availability is unknown.
Green:	Partial reception data is available.
Grey + red cross:	Partial reception data is not available.

Processing Throttle Indicator:
This icon comprises two adjacent LED indicators which show the status of the TSCA processing engine. The left indicator shows the “strained” status; that is whether throttling is being applied to cut down on the information being processed. The right indicator shows the “overwhelmed” status; that is whether the processing engine is able to cope with the amount of information in the stream even after throttling. The colors indicate the status as follows (The general color coding scheme is described in *Error Status LEDs*, see page 2–24):

Green:	OK
Amber:	Processing was strained/overwhelmed but is currently OK
Red:	Processing is currently strained/overwhelmed
White:	Processor state is unknown
Gray:	Test disabled

System Log Status : Shows the status of the system log which records system-wide events, for example, scripting errors. The color of the LED (in the body of the icon) indicates the most serious event state in the log. When the top surface of the icon is gray, it indicates that all entries in the log have been viewed.
Double-click the icon to view the log.

Gray:	The log is empty
Amber:	There are entries in the log, but none since the log was last viewed
Red:	There are new entries in the log

Analyzer Window - No Stream Available

If the user chooses not to select and analyze a stream, the screen will appear as shown in Figure 2–8; the analysis structure is present, but with no stream content.

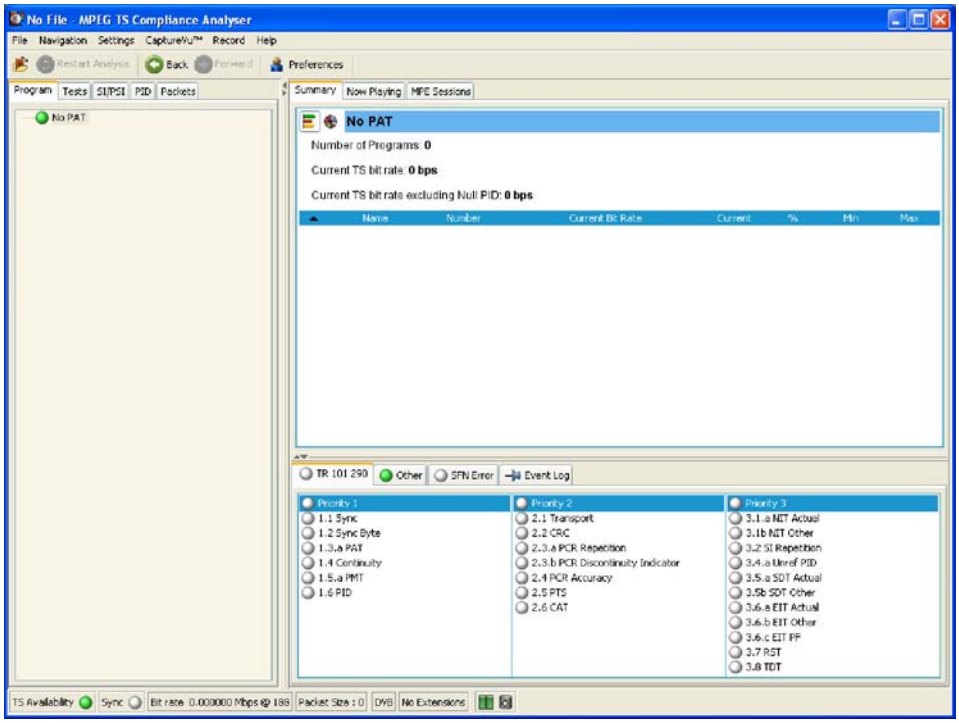


Figure 2-8: Analyzer window - no file

Error Status LEDs

A major feature used throughout the TSCA interface is error status LEDs that represent the status of the tests applied to associated items: for example, programs, tests and PIDs. Colors used are as follows:

(Red) Error; test failed

(Yellow) Transient error (error not currently being detected but has been seen since last reset)

(Green) No error; test passed

(Gray): Test disabled

(White) Test not applicable or unknown state

(Red) PID referenced but not found in the stream

When an LED represents a parent node in a tree (for example, a program node is the parent of elementary stream nodes), the color represents the worst case of all of its tests and the worst case of all of the tests represented by its child nodes.

Similarly, when an LED representing a parent node in a tree is disabled or enabled, all subsidiary (or child) nodes are also disabled or enabled to reflect the state of the parent node. When an LED representing a parent node is reset, all the child nodes are also reset.

***NOTE**. The color scheme described here is used throughout the TSCA interface. For example, the bit rate bars in the navigation views.*

Test Management Context Menu Options

Tests can be disabled and enabled as required using the context menu associated with the LED icon. However, it is important to note that the extent of the action depends on the hierarchical level of the icon chosen. For example, choosing Disable from a program node context menu will disable all tests in the program group.

Context Menus

Context menus (or right-click menus) provide an important way of navigating around the TSCA. They are available on most displayed objects, for example, program tree nodes. These menus provide options relevant to the selected object. For example, after failure, all tests associated with a node can be reset, by selecting the context menu option Reset All Tests. The context menu options provide both actions (for example, enable and disable a function) and shortcuts to associated objects in other views.

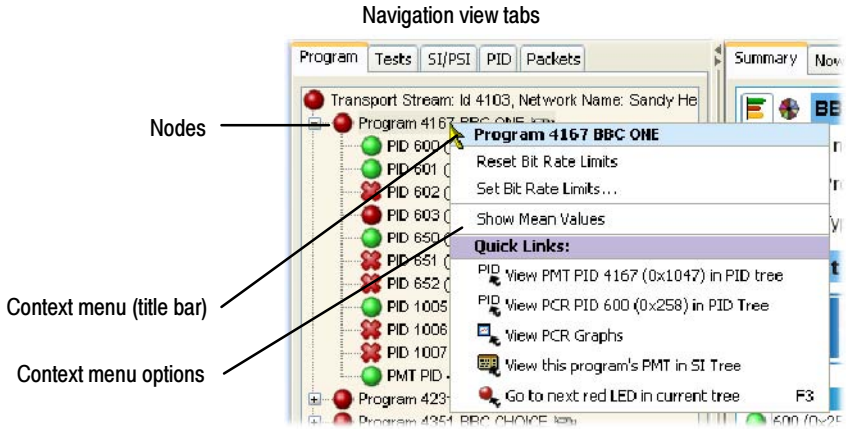


Figure 2-9: Context menu (example)

To view context menus, right-click an object. The menus are associated with node types (for example, a PID node). Note that node types can be displayed in more than one view; for example, PID nodes are displayed in the Program view and the PID view. All context menus have a title bar that indicates the node selected.

Using the Program View

The Program view is displayed when the Program tab is selected in the navigation tabbed pane. Initially the navigation view displays the top node of the program tree, which represents the analyzed transport stream from a program perspective.

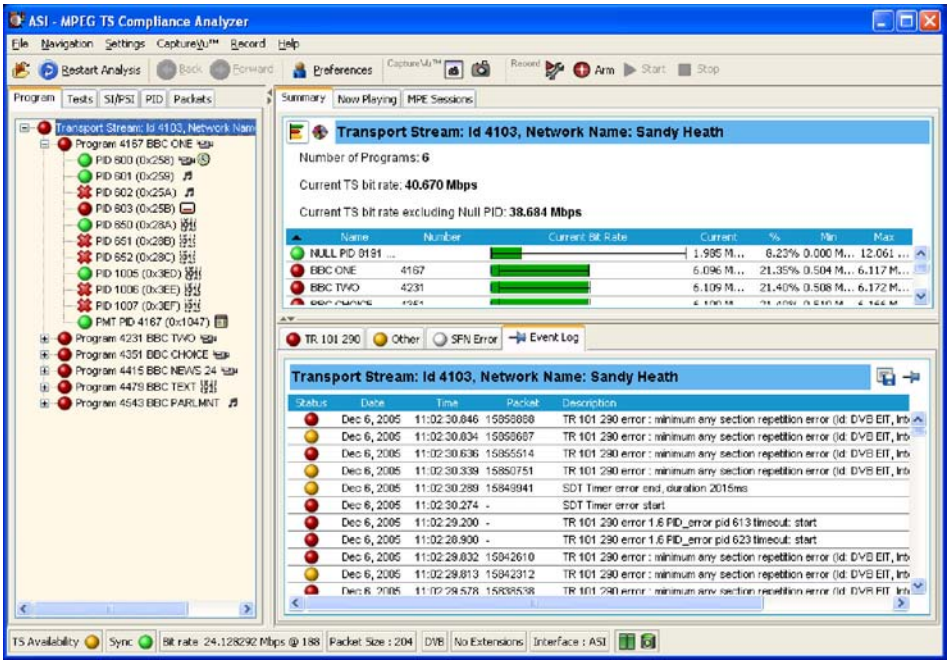


Figure 2- 10: Program View

The detail view shows details of the node highlighted in the navigation view.

With the tree expanded, the navigation view shows the makeup of the stream as shown in Figure 2–10; the stream display consists of the nodes shown in Figure 2–11:

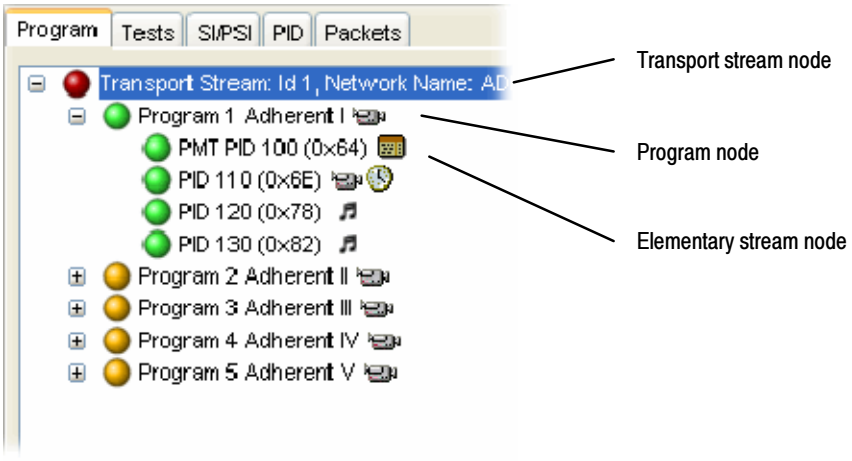


Figure 2-11: Program View nodes

Table 2–2 shows which information is available for each node.

Table 2-2: Program view tabs

Tabs / Node	Summary	Now Playing	MPE Sessions	Associated Tests	Graph - Bit Rate	Graph - PCR	Gra[ph - PTS	Event Log	Parameters
Transport Stream	✓	✓	✓	-	-	-	-	✓	-
Program	✓	✓	-	✓	✓	-	-	✓	✓
Elementary Stream	-	-	-	✓	✓	✓	✓	✓	✓

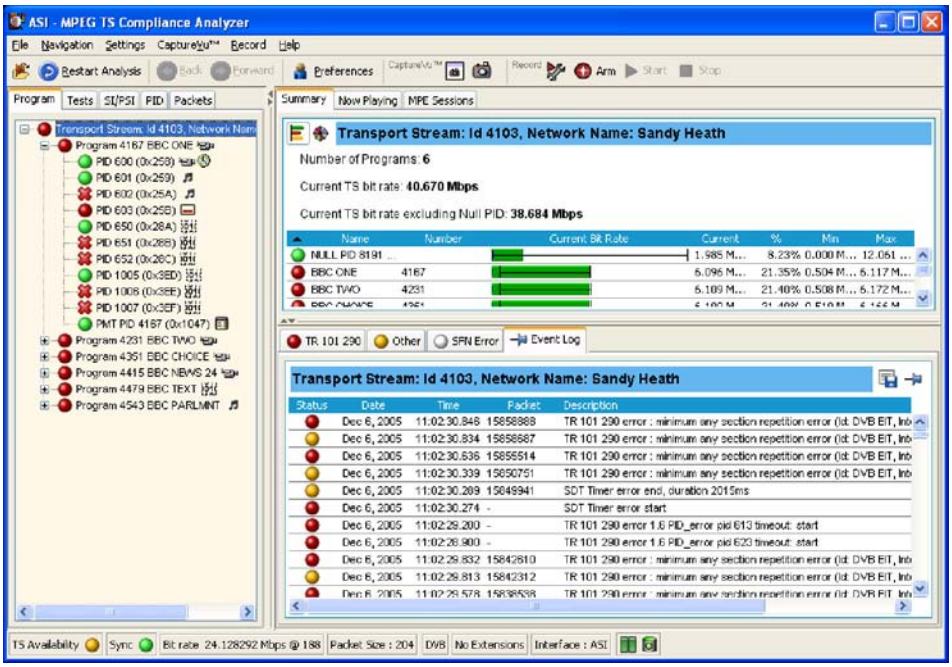
In DVB analysis mode, the MPE tab is always present; however, the MPE view will only be populated when MPE data is present in the stream (see page 2–98).

Pressing the F3 key on the keyboard (or selecting **Go to the next red LED in current tree** from one of the context menus) will highlight the next red LED in the current view. Only the lowest level nodes will be considered and highlighted in the search since the parent nodes simply reflect the state of the lowest level nodes.

Program Navigation - Transport Stream Node

The transport stream node represents the entire transport stream in terms of the programs that it contains. The adjacent LED icon represents the status of the entire transport stream; any status error in the stream will be represented by this LED. When this node is selected, the detail view displays the transport stream summary.

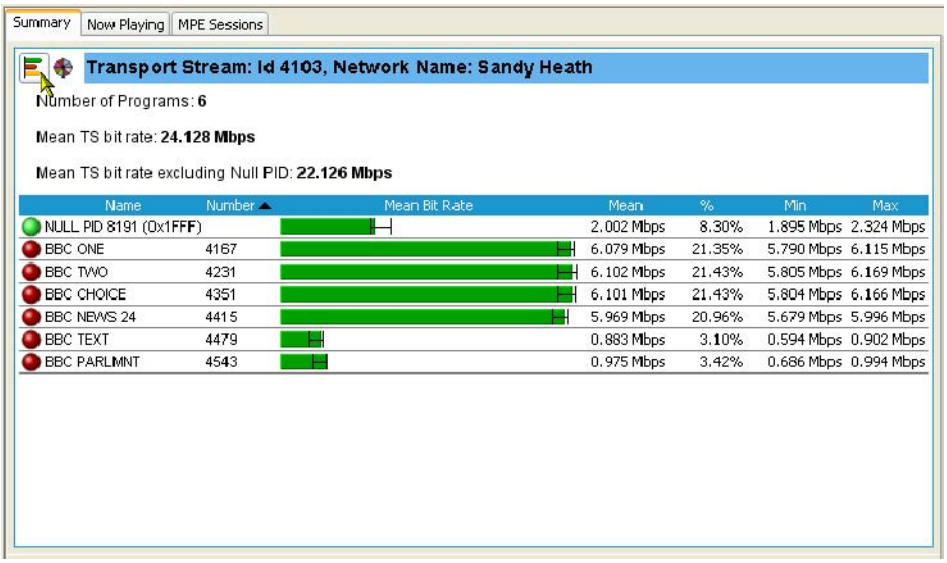
The associated detail view provides a program-orientated overview of the transport stream, allowing the user to see the relative data rates of all of the programs contained within the transport. A summary of the overall stream is also displayed. The information can be displayed as either a bar chart or as a pie chart.


ASI - MPEG TS Compliance Analyzer
File Navigation Settings CaptureVu™ Record Help
Restart Analysis Preferences
Program Tests SI/PSI PID Packets
Summary Now Playing MPE Sessions
Transport Stream: Id 4103, Network Name: Sandy Heath
Number of Programs: 6
Current TS bit rate: 40.670 Mbps
Current TS bit rate excluding Null PID: 38.684 Mbps
Name Number Current BR Rate Current % Min Max
NULL PID 8191
BBC ONE 4167
BBC TWO 4231
TR 101 290 Other SFN Error Event Log
Transport Stream: Id 4103, Network Name: Sandy Heath
Status Date Time Packet Description
TS Availability Sync Bit rate 24.128292 Mbps @ 188 Packet Size : 204 DVB No Extensions Interface : ASI

The data rate of a program is the cumulative data rate of all the PIDs that are associated with that particular program, including PCR and ECM PIDs.

***NOTE**. Components can be shared between programs, so the overall data rate of all of the programs may appear to be greater than the total data rate of the transport stream as shown in the status bar.*

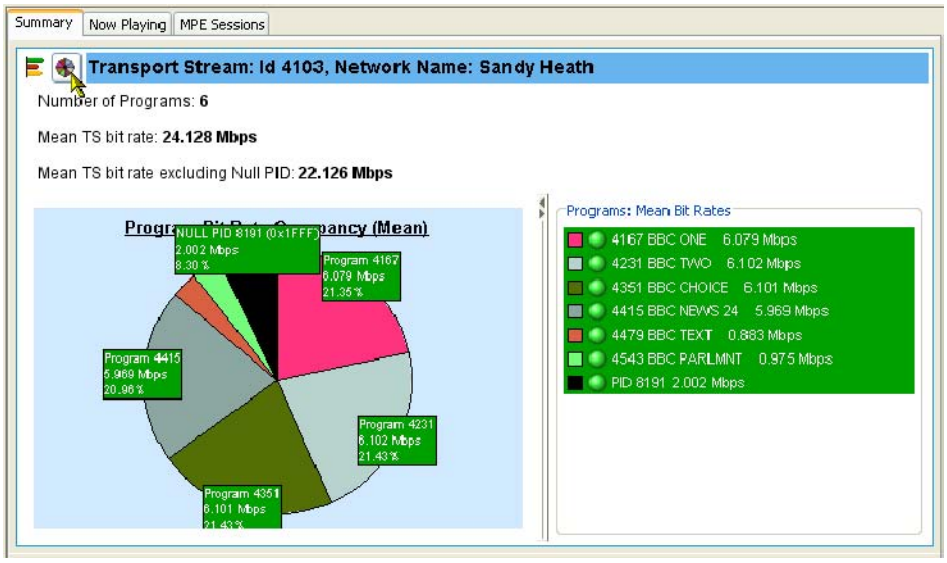
Bar Chart Display the transport stream bar chart by selecting the bar chart icon.


Summary
Now Playing
MPE Sessions
Transport Stream: Id 4103, Network Name: Sandy Heath
Number of Programs: 6
Mean TS bit rate: 24.128 Mbps
Mean TS bit rate excluding Null PID: 22.126 Mbps
Name
Number
Mean Bit Rate
Mean
%
Min
Max
NULL PID 8191 (0x1FFF) 2.002 Mbps 8.30% 1.895 Mbps 2.324 Mbps
BBC ONE 4167 6.079 Mbps 21.35% 5.790 Mbps 6.115 Mbps
BBC TWO 4231 6.102 Mbps 21.43% 5.805 Mbps 6.169 Mbps
BBC CHOICE 4351 6.101 Mbps 21.43% 5.804 Mbps 6.166 Mbps
BBC NEWS 24 4415 5.969 Mbps 20.96% 5.679 Mbps 5.996 Mbps
BBC TEXT 4479 0.883 Mbps 3.10% 0.594 Mbps 0.902 Mbps
BBC PARLMNT 4543 0.975 Mbps 3.42% 0.686 Mbps 0.994 Mbps

Each program identified in the stream is allocated one row of the table; related information includes the overall program status (icon), the program name, program number and the maximum, minimum and average bit rates. The Null PID is not shown in this view.

In addition to the basic display, you can associate a maximum and minimum threshold value with each program in the bar chart (see page 2-89). For deferred analysis, where these values are set after analysis, the stream must be reanalyzed for them to be applied. In real-time analysis, the new values will take effect immediately. The color of the bit rate bar indicates that the program has stayed within the bit rate limits (green) or exceeded the limits (red).

Pie Chart Display the transport stream pie chart by selecting the pie chart icon.



The pie chart view is divided into two panes. The left pane shows the pie chart; the right legend provides a list of the component programs. Each program is color-coded; related information given includes the overall program status (icon), the program name and number and the bit rate. The values given in the pie chart labels are bit rates expressed as percentages of the overall bit rate. The Null PID is shown in this view.

The color of the bit rate labels (and the bit rate values in the legend) reflects the status of the bit rate measurement; for example, green indicates that the program has stayed within the bit rate limits and red indicates that the bit rate has exceeded the limits.

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Bit Rate Value Display

You can toggle the bit rate displays between the mean bit rate and the current bit rate by selecting or deselecting the **Show Mean Values** option on the detail view context menus (see Figure 2-12). A checkmark adjacent to the option indicates that mean values are to be displayed.

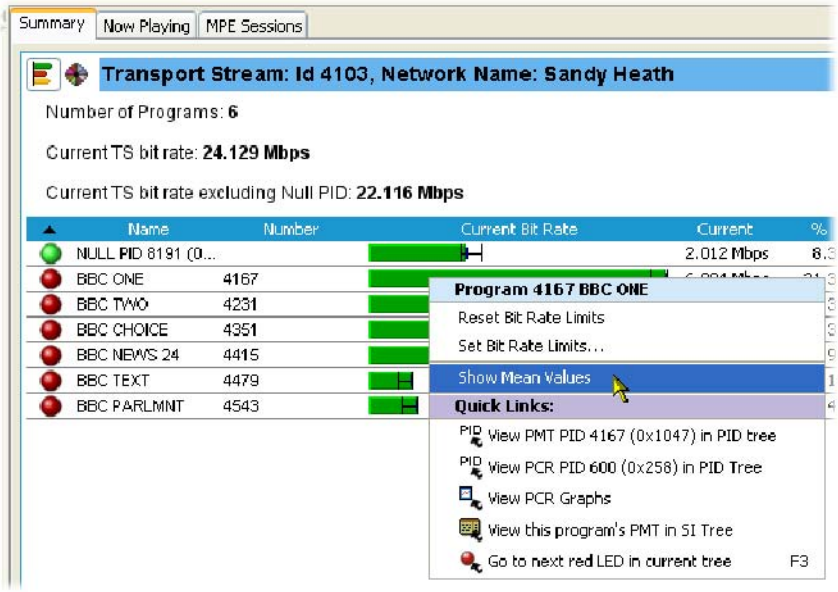


Figure 2-12: Bit rate values display

***NOTE**. The bit rate value shown in the Status Bar is always the mean bit rate. It is unaffected by the mean/current selection.*

Test Status Panes

The lower view pane allows the user to see a summary of the states of all the associated tests as well as the event log for the entire transport stream (an un-filtered event log). The test tabs available will depend on the interpretation standard chosen. For example, with the DVB interpretation standard, the available tabs are TR 101 209 and Other. Other interpretation standards will generate different tabs and different sets of tests (see *SI/PSI Nodes*, page 2-133). When any test in the transport stream has failed (and has not been reset), the user can identify which individual tests have failed by observing the red LEDs.

You can use the context menus to reset and disable tests, to set alarms, Capture-Vu Breakpoints and record flags, and to jump to associated tests.

Event Log

The Event Log (Figure 2-13) displays the log entries for the whole transport stream. In deferred mode, the packet generating the error report can be inspected by highlighting the error and selecting Go to packet from the context menu. Similarly, in real-time analysis mode, and where an event concerns a PID carrying a PCR, you can use the context menu to jump to the relevant PCR graph.

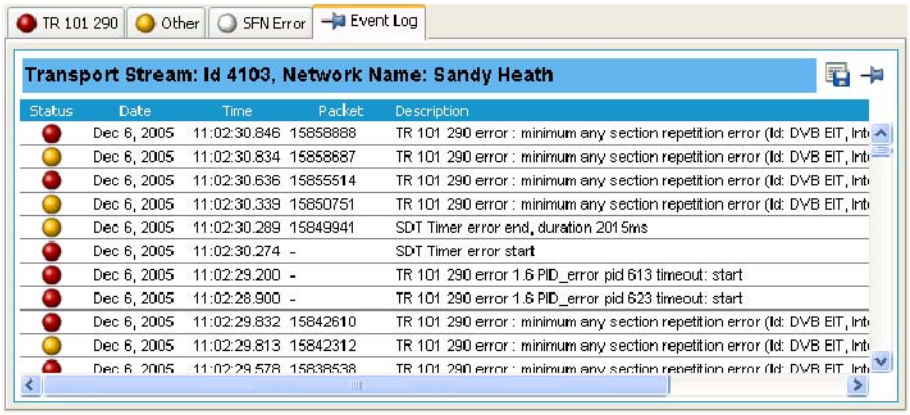

TR 101 290
Other
SFN Error
Event Log
Transport Stream: Id 4103, Network Name: Sandy Heath
Status Date Time Packet Description
Dec 6, 2005 11:02:30.846 15858888 TR 101 290 error : minimum any section repetition error (Id: DVB EIT, Int
Dec 6, 2005 11:02:30.834 15858887 TR 101 290 error : minimum any section repetition error (Id: DVB EIT, Int
Dec 6, 2005 11:02:30.636 15855514 TR 101 290 error : minimum any section repetition error (Id: DVB EIT, Int
Dec 6, 2005 11:02:30.339 15850751 TR 101 290 error : minimum any section repetition error (Id: DVB EIT, Int
Dec 6, 2005 11:02:30.289 15849941 SDT Timer error end, duration 2015ms
Dec 6, 2005 11:02:30.274 - SDT Timer error start
Dec 6, 2005 11:02:29.200 - TR 101 290 error 1.6 PID_error pid 613 timeout: start
Dec 6, 2005 11:02:28.900 - TR 101 290 error 1.6 PID_error pid 623 timeout: start
Dec 6, 2005 11:02:29.832 15842610 TR 101 290 error : minimum any section repetition error (Id: DVB EIT, Int
Dec 6, 2005 11:02:29.813 15842312 TR 101 290 error : minimum any section repetition error (Id: DVB EIT, Int

Figure 2-13: Event Log

Two buttons are available in the Error Log toolbar:

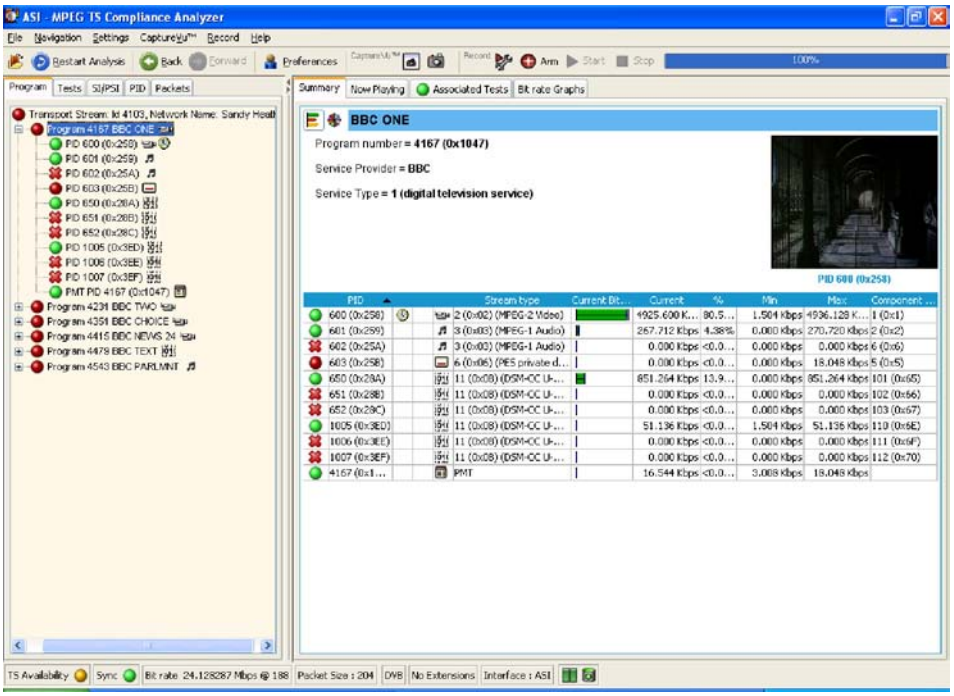
Pin log / Log is Pinned.

Export Log.

The buttons are described in detail in *Event Log*, page 2-84.

Program Navigation - Program Nodes

Each of the program nodes in the transport stream represents a single program referenced within the stream. When a program node is selected in the navigation view, the detail pane displays the details of the program. The LED adjacent to the program node represents the status of its child nodes (elementary streams) and the related tests.


ASI - MPEG TS Compliance Analyzer
File Navigation Settings CaptureVu Record Help
Restart Analysis Back Forward Preferences
Program Tests SI/PSI PID Packets
Summary Now Playing Associated Tests Bit rate Graphs
BBC ONE
Program number = 4167 (0x1047)
Service Provider = BBC
Service Type = 1 (digital television service)
PID 600 (0x258)
TS Availability Sync Packet Size : 204 DVB No Extensions Interface : ASI

The program detail view provides the user with an overview of the selected program, allowing the user to see the relative data rates and stream types of all of the PIDs that are associated with the program (including PCR and ECM PIDs). If the program contains an MPEG2 video stream, it is decoded to produce a thumbnail picture of the content; this is updated during real time. Similarly, where EPG information is associated with the program, a summary (Now and Next program) is displayed. PID content is indicated using icons, which are described on page 2-65. Bar chart and pie chart views are available.

PID related information is available under the Summary tab.

The Now Playing tab displays thumbnails for all programs (where available).

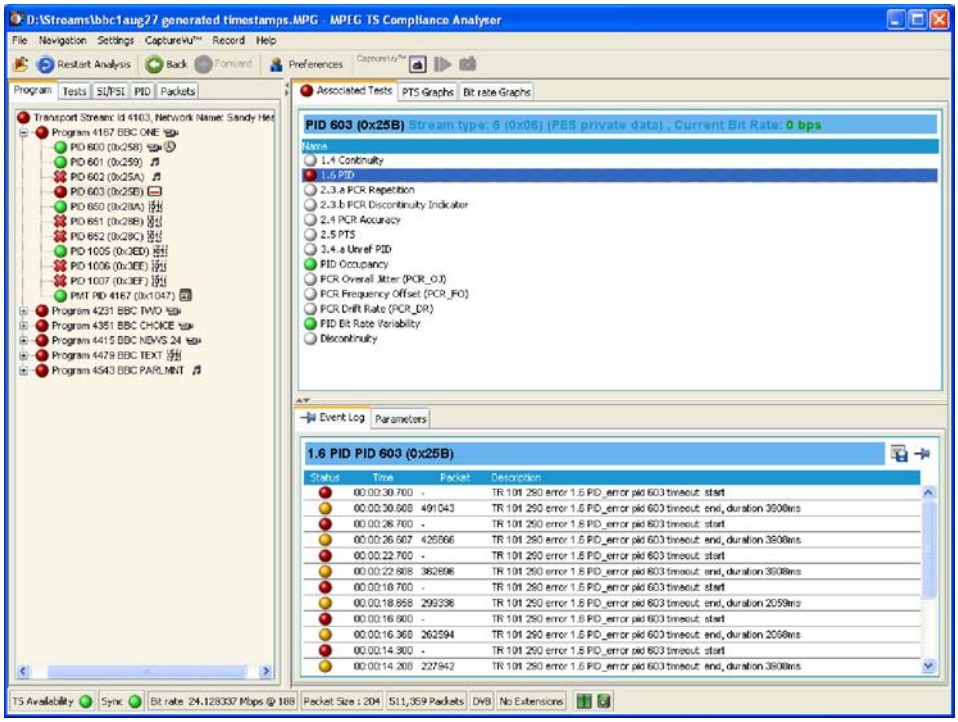
The Associated Test tab shows tests related to the program. Similarly, the Bit rate Graphs tab displays the program bit rate in graph form.

The Parameters view displays the parameters associated with the currently selected test in the Associated Tests pane (if applicable). As well as displaying the current, minimum and maximum values for each of the test parameters, you can change the parameter value. For deferred analysis, where these values are set after analysis, the stream must be reanalyzed for them to be applied. In real-time analysis, the new values will take effect immediately.

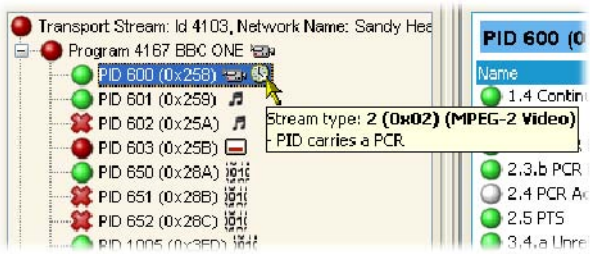
The Event Log shows the errors for the highlighted test. When no tests are selected, the event log will show the events related to all tests associated with the elementary stream selected in the program tree.

Program Navigation - Elementary Stream Node

Each of the elementary stream nodes in the program tree represents a single elementary stream referenced by the parent program. When this node is selected, the view pane displays the Elementary Stream summary view.


D:\Streams\bbc1aug27 generated timestamps.MPG - MPEG TS Compliance Analyser
File Navigation Settings CaptureWu™ Record Help
Restart Analysis Back Forward Preferences
Program Tests SI/PSI PID Packets
Associated Tests PTS Graphs Bit rate Graphs
PID 603 (0x25B) Stream type: 6 (0x06) (PES private data) , Current Bit Rate: 0 bps
1.4 Continuity
1.5 PID
2.3.a PCR Repetition
2.3.b PCR Discontinuity Indicator
2.4 PCR Accuracy
2.5 PTS
3.4.a Unref PID
PID Occupancy
PCR Overall Jitter (PCR_OJ)
PCR Frequency Offset (PCR_FO)
PCR Drift Rate (PCR_DR)
PID Bit Rate Variability
Discontinuity
Event Log Parameters
1.6 PID PID 603 (0x25B)
Status Time Packet Description
TS Availability Sync Bit rate: 24.128337 Mbps @ 188 Packet Size : 204 511,359 Packets DVB No Extensions

In addition, when the cursor is hovered over the elementary stream node, a tooltip is displayed giving stream type and description.



An LED associated with each elementary stream node indicates the status of the tests relating to the elementary stream.

When the selected elementary stream PID contains PCR information, PCR trend analysis views are also available, allowing the user to display graphs of PCR accuracy and PCR interval data. When the transport stream contains time stamping data, the PCR overall jitter, PCR frequency offset, PCR arrival time and PCR drift rate graphs are also available.

NOTE. *Graph Management and PCR Graphs are described in more detail in the* Common User Interface Concepts *section of this manual (see page 2-63).*

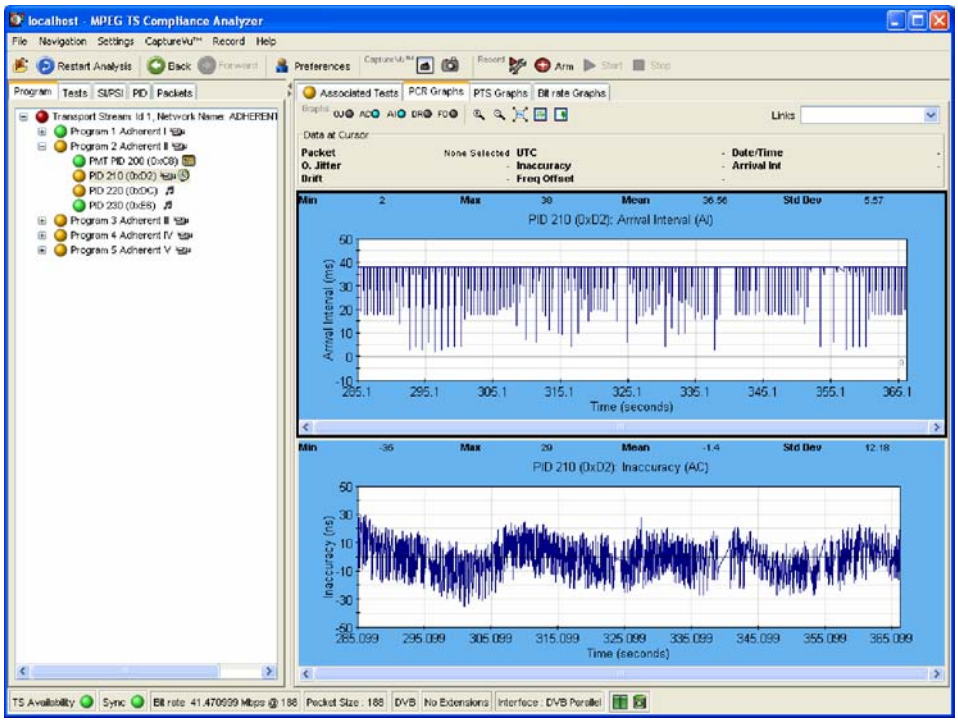


Figure 2-14: PCR Graphs view

The Associated Tests tab shows tests related to the elementary stream node.

The Parameters view displays all of the parameters for the currently selected test in the Associated Tests pane (if applicable). As well as displaying the current, minimum and maximum values for each of the test parameters, you can change the parameter value. For deferred analysis, when values are changed, the stream must be reanalyzed for them to be applied. In real time, the changes will take effect immediately.

Similarly, the Event Log shows the errors for the highlighted test. When no tests are selected, the event log will show the events related to all tests associated with the elementary stream selected in the program tree.

Using the Tests View

The Tests view displays test information relevant to the transport stream being analyzed. The view is displayed when the Tests tab is selected in the navigation tabbed pane (see Figure 2–15).

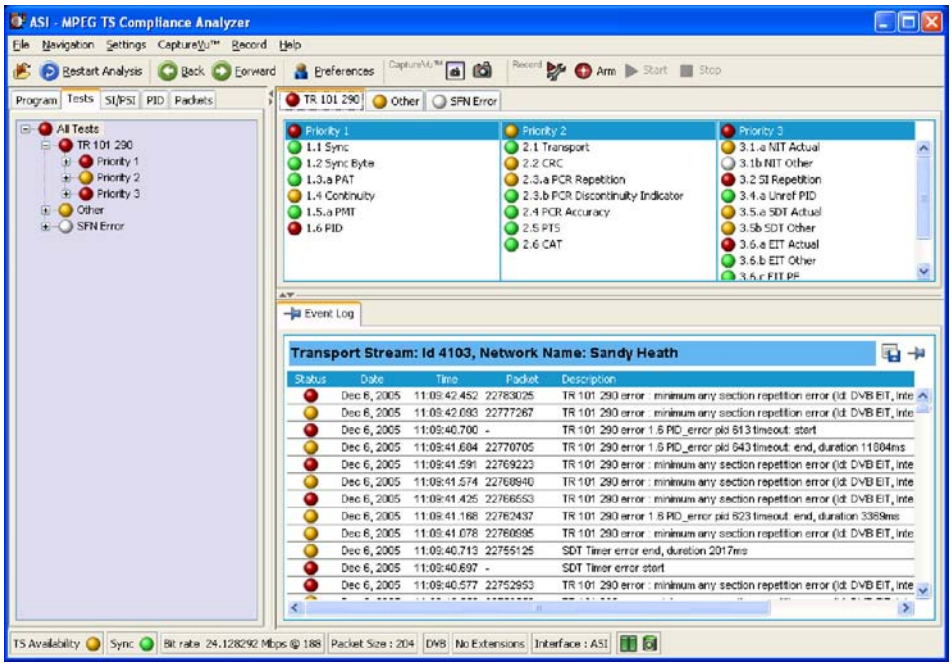


Figure 2- 15: Tests Navigation view

The view displays a test tree which represents all the tests that have been applied to the analyzed transport stream. Figure 2–16 shows the nodes available in the navigation view.

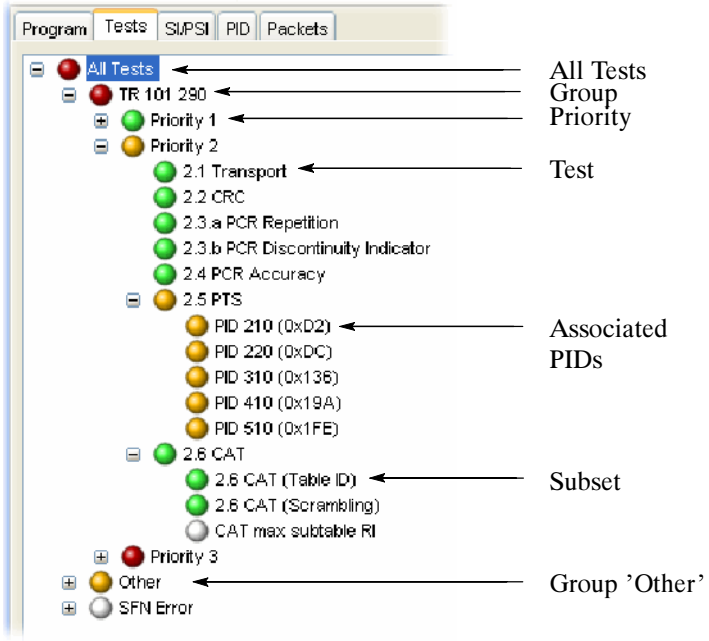
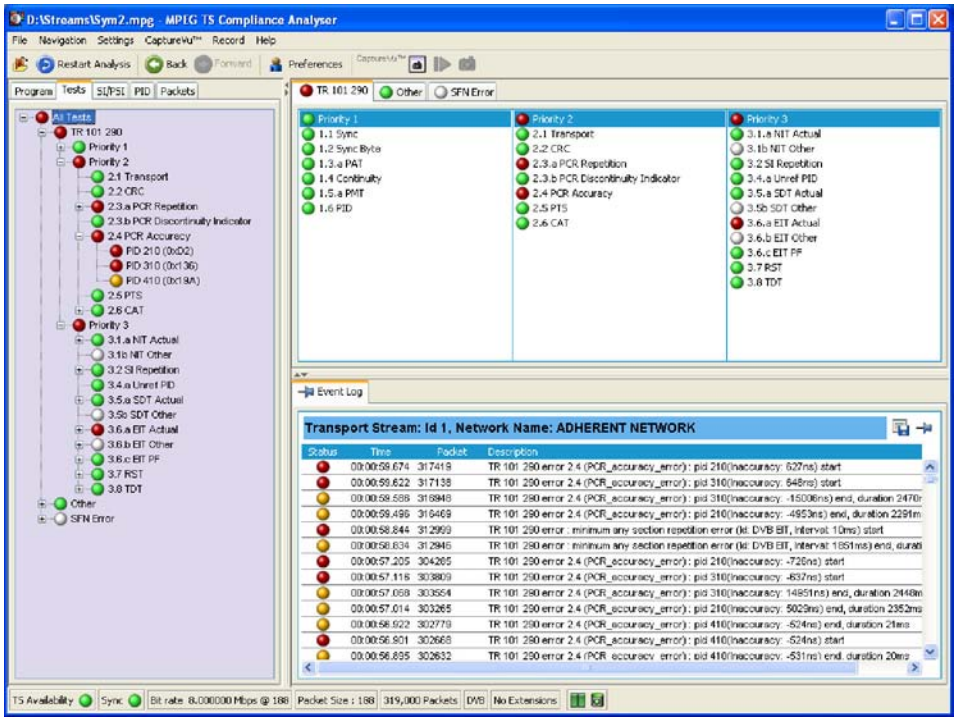


Figure 2-16: Test View nodes

Test Structure

The test tree structure represents all of the tests that can be applied to a transport stream complying with a particular digital video standard: MPEG, DVB, ATSC, ISDB-S and ISDB-T. Select the standard before beginning analysis. The test tree contains nodes for each individual test that the analyzer can implement.

An example of a tree structure for a selected standard is the TR 101 290 group of tests for DVB transport streams (shown in Figure 2-16). The Group node is split into priority groups (First Priority, Second Priority and Third Priority). Each of these priority groups contains a number of individual tests.



Test grouping differs between digital video standards; however, all of the currently implemented standards contain a subset of the relevant TR 101 290 tests. Note that in standards other than DVB, the tests are not numbered.

Where relevant, PIDs will be associated with a test in the test tree when the test has either been disabled or when it has failed.

The LED associated with each node indicates the status of the node and its child node tests (see *Error Status LEDs* on page 2-24).

Figure 2–17 shows an example of the test view for an ISDB-T stream. Note the additional group node - ISDB-T Tests.

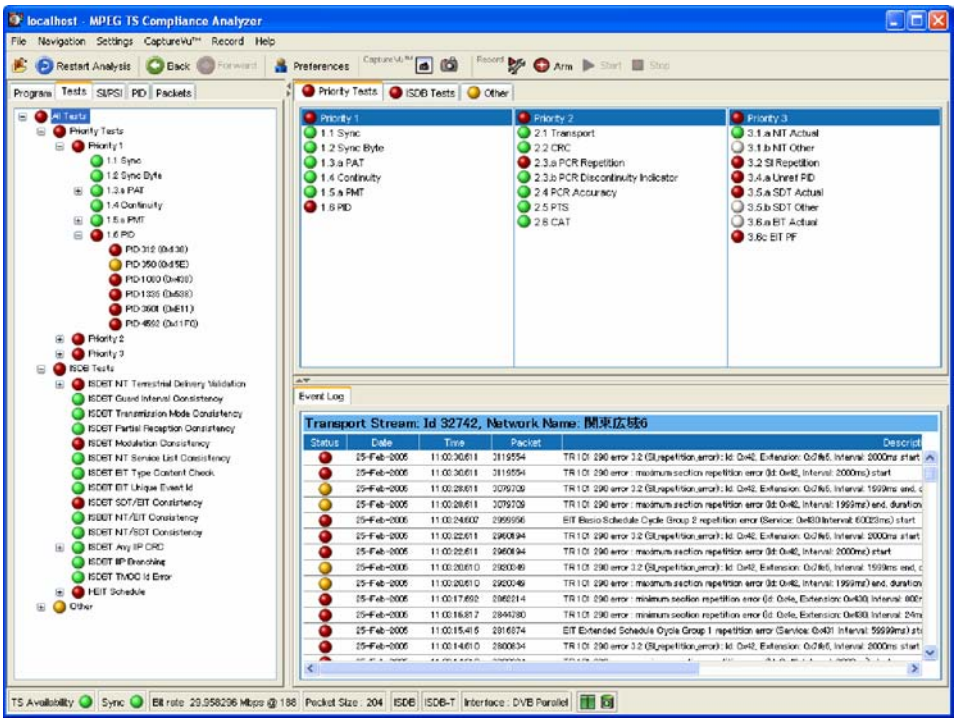


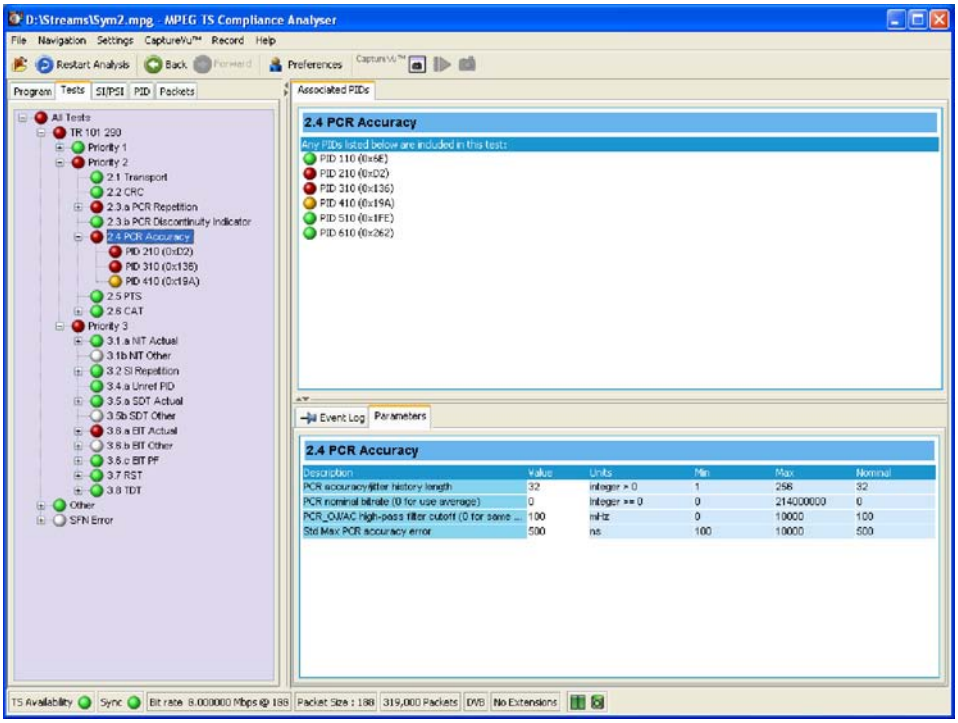
Figure 2- 17: Test view - ISDB- T standard (example)

Tests Navigation - All Tests

The detail view when the All Tests node is selected is shown in Figure 2–15. In addition to a summary of all tests, the event log shows the most recent 10000 events that have occurred during analysis of the stream.

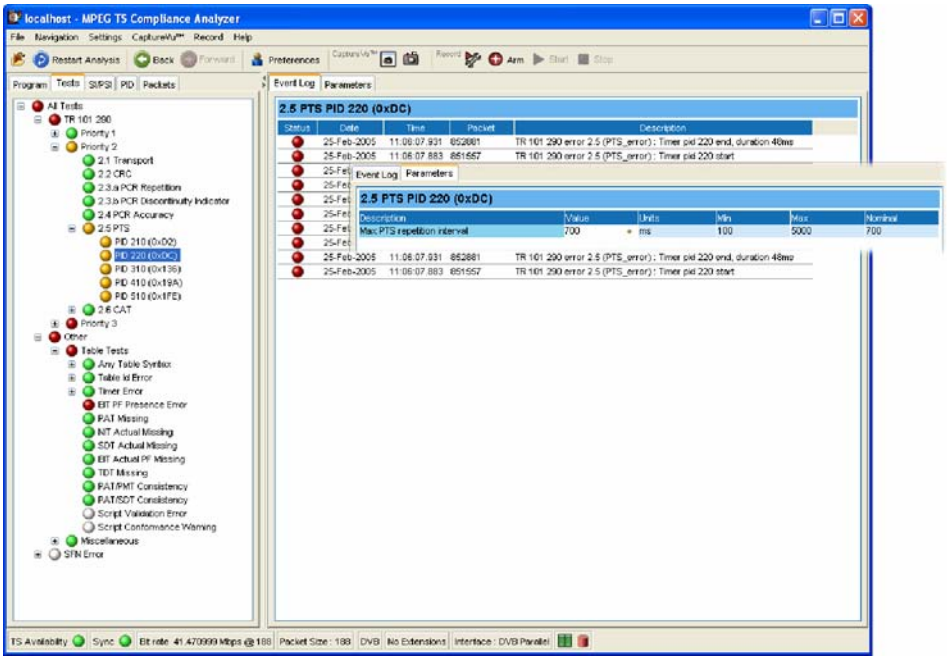
Test Navigation - Test Nodes

When you select a test node, the Associated PIDs pane displays a summary of all of the PIDs and an event log listing all events that are associated with the test. Where parameters are applicable to the test, you can modify them under the Parameters tab.


D:\Streams\Sym2.mpg - MPEG TS Compliance Analyser
File Navigation Settings CaptureVu™ Record Help
Restart Analysis Back Forward Preferences
Program Tests SI/PSI PID Packets
All Tests
TR 101 290
Priority 1
Priority 2
2.1 Transport
2.2 CRC
2.3.a PCR Repetition
2.3.b PCR Discontinuity Indicator
2.4 PCR Accuracy
PID 210 (0xD2)
PID 310 (0x136)
PID 410 (0x19A)
2.5 PTS
2.6 CAT
Priority 3
3.1.a NIT Actual
3.1.b NIT Other
3.2 SI Repetition
3.4.a Unref PID
3.5.a SDT Actual
3.5.b SDT Other
3.6.a EIT Actual
3.6.b EIT Other
3.6.c EIT PF
3.7 RST
3.8 TDT
Other
SPN Error
Associated PIDs
2.4 PCR Accuracy
Any PIDs listed below are included in this test:
PID 110 (0x6E)
PID 210 (0xD2)
PID 310 (0x136)
PID 410 (0x19A)
PID 510 (0x1FE)
PID 610 (0x262)
Event Log Parameters
2.4 PCR Accuracy
Description Value Units Min Max Nominal
PCR accuracy jitter history length 32 integer > 0 1 256 32
PCR nominal bitrate (0 for use average) 0 integer >= 0 0 214000000 0
PCR_OJIAC high-pass filter cutoff (0 for same ... 100 mHz 0 10000 100
Std Max PCR accuracy error 500 ns 100 10000 500
TS Availability Sync Bit rate: 8.000000 Mbps @ 188 Packet Size : 188 319,000 Packets DVB No Extensions

Test Navigation - PID Nodes

Where tests have failed, the PIDs affected are listed under the test node in the Tests navigation view. Selecting a PID will display the Event Log and Parameters for the PID and the test in the detail view.



Using the Tables View

The Tables view (SI/PSI tab) displays the service information in tree form, in keeping with the other navigation views. The tree represents the service information tables that have occurred in the analyzed stream and which comply with the selected digital video standard. This includes MPEG program specific information, DVB service information and ATSC and ISDB program and system information protocol. The tree contains nodes for each table found; tables/nodes are grouped together by functionality. Figure 2–18 shows an example of Table navigation view with DVB stream interpretation selected.

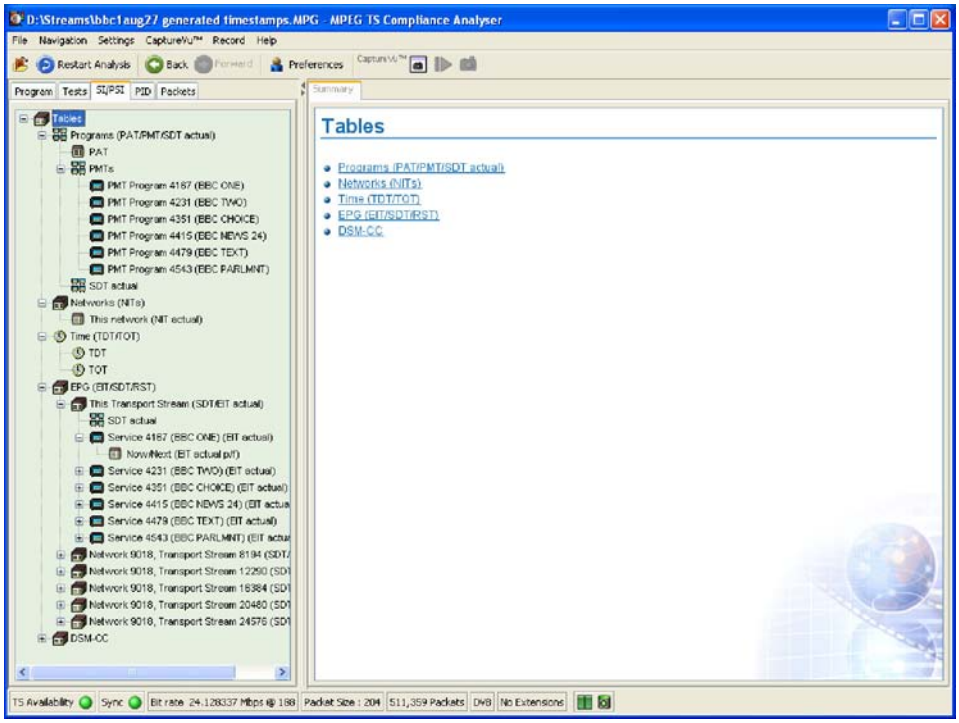


Figure 2- 18: Tables view

Every node within the service information tree has a corresponding summary view. In addition to this, nodes that represent tables will also provide the user with access to the table structure and hex data (*Tables Detail View - Section View* on page 2–47) as well as graphical displays of data rates and interval data (*Tables Detail View - SI Repetition Graphs* on page 2–49).

Some of the nodes that represent less common tables or table groups may not have specific summary views available in the analyzer; in these cases, a generic summary view is used.

Table Summary Pane

The table summary view provides a summary of the table related information for the analyzed transport stream. There is a table summary view for every node of the service information; the content is dictated by the selected node.

All summary views for nodes that represent an individual table or subtable will display the table identity and version number of the table from which the information is extracted. Where relevant, links (underlined text) are provided to associated objects; for example, in the programs summary (Figure 2–19), links are provided to the individual program summary views. Similarly, arrow icons provide links to the electronic program guide (EPG) tables. Where the section is carried on a PID, a link is also provided to the PID view.

Figure 2–19 shows an example of the summary pane with the PMT PIDs node selected in the navigation view.

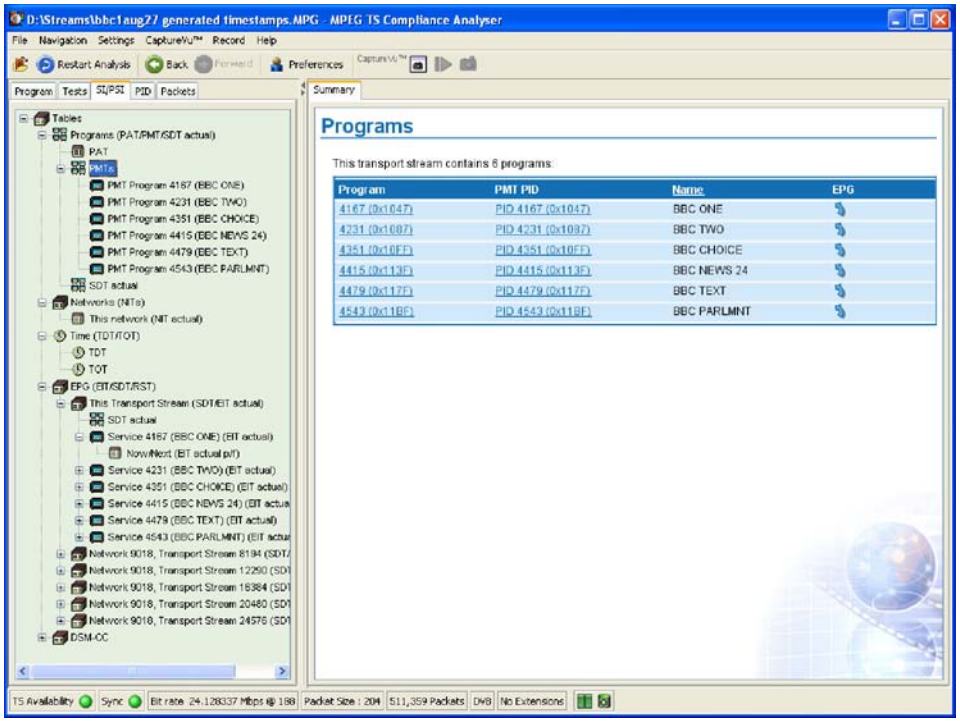
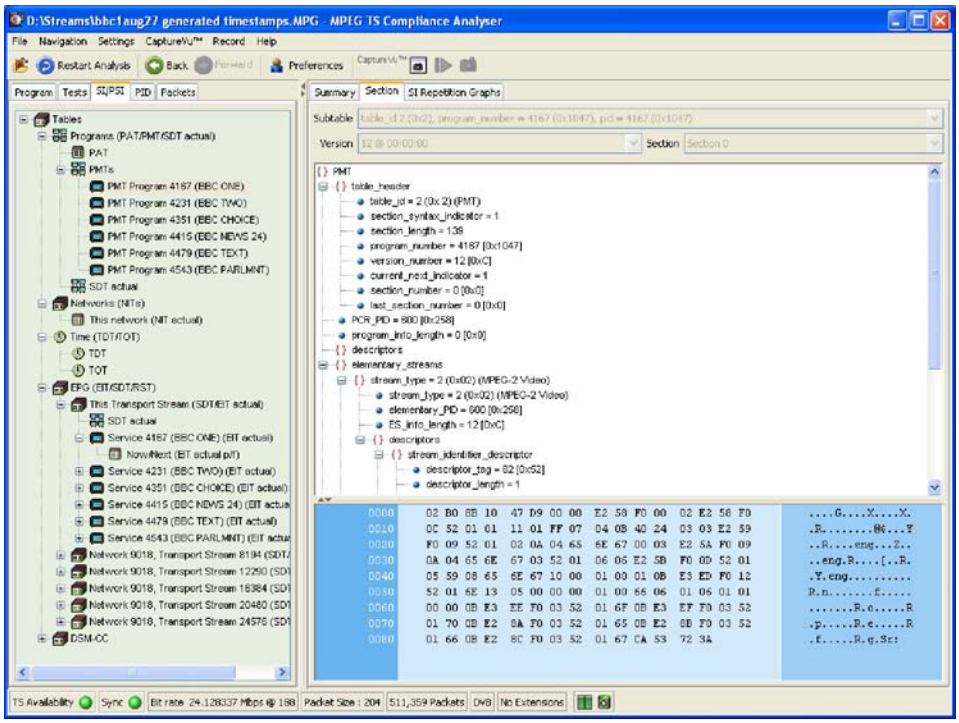

D:\Streams\bbc1aug27 generated timestamps.MPG - MPEG TS Compliance Analyser
File Navigation Settings CaptureVu™ Record Help
Restart Analysis Back Preferences
Program Tests SI/PSI PID Packets
Summary
Programs
This transport stream contains 6 programs:
Program PMT PID Name EPG
4167 (0x1047) PID 4167 (0x1047) BBC ONE
4231 (0x1087) PID 4231 (0x1087) BBC TWO
4351 (0x10FF) PID 4351 (0x10FF) BBC CHOICE
4415 (0x113F) PID 4415 (0x113F) BBC NEWS 24
4479 (0x117F) PID 4479 (0x117F) BBC TEXT
4543 (0x11BF) PID 4543 (0x11BF) BBC PARLMNT
Tables
Programs (PAT/PMT/SDT actual)
PAT
PMTs
PMT Program 4167 (BBC ONE)
PMT Program 4231 (BBC TWO)
PMT Program 4351 (BBC CHOICE)
PMT Program 4415 (BBC NEWS 24)
PMT Program 4479 (BBC TEXT)
PMT Program 4543 (BBC PARLMNT)
SDT actual
Networks (NITs)
This network (NIT actual)
Time (TDT/TOT)
TDT
TOT
EPG (EIT/SDT/RST)
This Transport Stream (SDT/EIT actual)
SDT actual
Service 4167 (BBC ONE) (EIT actual)
Now/Next (EIT actual p/f)
Service 4231 (BBC TWO) (EIT actual)
Service 4351 (BBC CHOICE) (EIT actual)
Service 4415 (BBC NEWS 24) (EIT actu
Service 4479 (BBC TEXT) (EIT actual)
Service 4543 (BBC PARLMNT) (EIT actu
Network 9018, Transport Stream 8194 (SDT
Network 9018, Transport Stream 12290 (SD
Network 9018, Transport Stream 16384 (SD
Network 9018, Transport Stream 20480 (SD
Network 9018, Transport Stream 24576 (SD
DSM-CC
TS Availability Sync Bit rate 24.128337 Mbps @ 188 Packet Size : 204 511,359 Packets DVB No Extensions

Figure 2–19: Tables view - Programs (example)

EPG Views

A specific departure from the Table Summary view described previously is the EPG view; this is displayed when a section of the EPG table is highlighted. For a description of the general presentation of the EPG view, see page 2–93.

Tables Detail View - Section View



The detailed section view is available when the selected node in the service information tree represents a table or subtable in the transport stream. During real-time analysis the view is continually updated.

The subtable identity, version and section are displayed at the top of the table pane.

- In deferred mode, where two or more subtables, versions or sections are found in the stream, the relevant field is active and an alternative selection can be made from the drop-down list.
- In real-time mode, only the latest version and section can be viewed.

The table pane shows all fields that make up a section (for example, PMT). The fields are arranged in a hierarchical order. The presence of subordinate fields is indicated using a { } symbol adjacent to the container field. The container can be expanded or collapsed by clicking the + or – icon.

Below the table pane, the data source is displayed. The data pane shows the data bytes (in both hexadecimal number format and ASCII character format) for the selected table, version and section. When a node is selected in the table pane the bytes that make up the selected node (including the subordinate nodes) are highlighted in the hex data pane (refer to Figure 2–20).

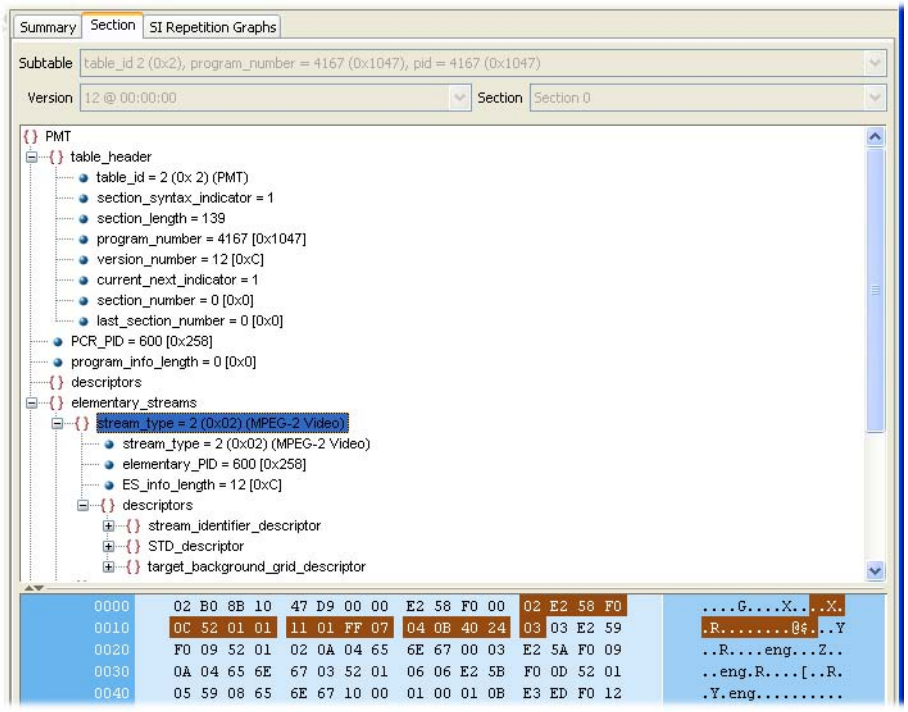

Summary
Section
SI Repetition Graphs
Subtable
table_id 2 (0x2), program_number = 4167 (0x1047), pid = 4167 (0x1047)
Version
12 @ 00:00:00
Section
Section 0
PMT
table_header
table_id = 2 (0x 2) (PMT)
section_syntax_indicator = 1
section_length = 139
program_number = 4167 [0x1047]
version_number = 12 [0xC]
current_next_indicator = 1
section_number = 0 [0x0]
last_section_number = 0 [0x0]
PCR_PID = 600 [0x258]
program_info_length = 0 [0x0]
descriptors
elementary_streams
stream_type = 2 (0x02) (MPEG-2 Video)
stream_type = 2 (0x02) (MPEG-2 Video)
elementary_PID = 600 [0x258]
ES_info_length = 12 [0xC]
descriptors
stream_identifier_descriptor
STD_descriptor
target_background_grid_descriptor
0000 02 B0 8B 10 47 D9 00 00 E2 58 F0 00 02 E2 58 F0 ....G....X..X.
0010 0C 52 01 01 11 01 FF 07 04 0B 40 24 03 03 E2 59 .R.....@$...Y
0020 F0 09 52 01 02 0A 04 65 6E 67 00 03 E2 5A F0 09 ..R....eng...Z..
0030 0A 04 65 6E 67 03 52 01 06 06 E2 5B F0 0D 52 01 ..eng.R....[..R.
0040 05 59 08 65 6E 67 10 00 01 00 01 0B E3 ED F0 12 .Y.eng.........

Figure 2-20: Section payload

If the section is corrupted or empty, the hex view background is red instead of blue.

Tables Detail View - SI Repetition Graphs

The section graph view will be available when the selected node in the service information tree represents a table or subtable in the transport stream. You can view graphs of the following data:

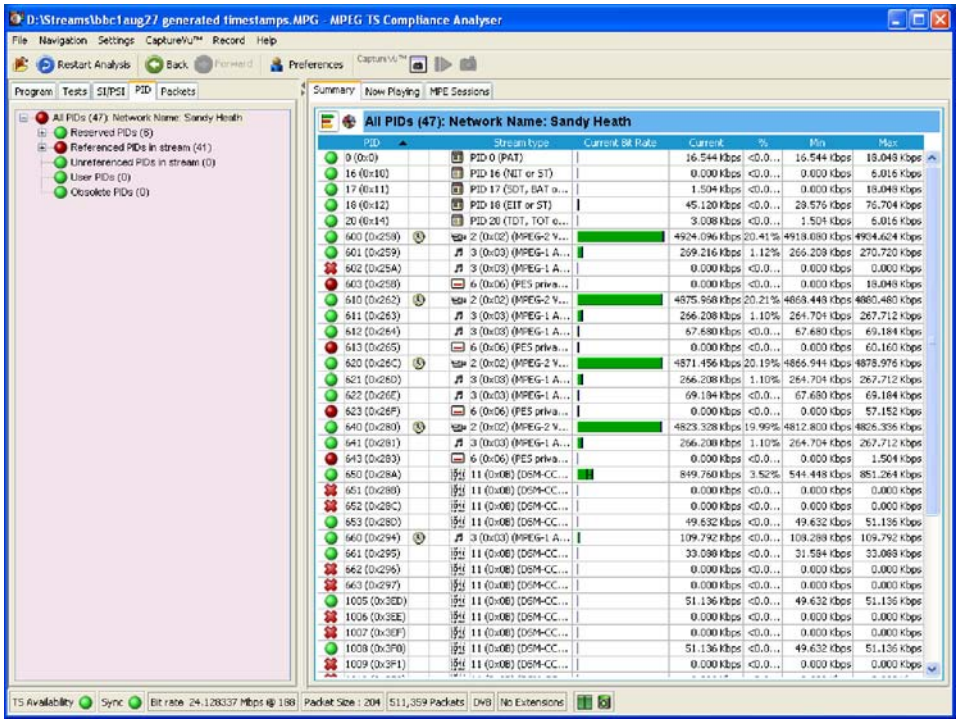
- Section repetition interval.
  This graph displays the interval between two sections of a table on a particular PID.
- Subtable intersection gap.
  This graph displays the interval between sections in a particular subtable.
- Subtable repetition interval.
  This graph displays the time between receiving one complete subtable and receiving the next complete subtable.

***NOTE**. Not all of the above graph types are relevant to all table types*

Graph Management is described in more detail in the Common User Interface Concepts *section of this manual (see page 2–63).*

Using the PID View

The PID view displays information about all of the PIDs found in the transport stream being analyzed. The navigation view contains the PID tree; this is a tree structure representing all of the PIDs that have occurred within the transport stream.


D:\Streams\bbc1aug27 generated timestamps.MPG - MPEG TS Compliance Analyser
File Navigation Settings CaptureVu™ Record Help
Restart Analysis Back Preferences
Program Tests SI/PSI PID Packets
All PIDs (47): Network Name: Sandy Heath
Reserved PIDs (8)
Referenced PIDs in stream (41)
Unreferenced PIDs in stream (0)
User PIDs (0)
Obsolete PIDs (0)
Summary Now Playing MPE Sessions
All PIDs (47): Network Name: Sandy Heath
PID Stream type Current Bit Rate Current % Min Max
TS Availability Sync Bit rate: 24.128337 Mbps @ 188 Packet Size : 204 511,359 Packets DVB No Extensions

In DVB analysis mode, the MPE tab is always present; however, the MPE view will only be populated when MPE data is present in the stream (see page 2–98).

PID View - All PIDs

In the navigation view, PIDs are grouped under four subordinate nodes:

- Reserved PIDs
- Referenced PIDs
- Unreferenced PIDs
- User PIDs
- Obsolete PIDs

The number of PIDs in each group is shown adjacent to the node. The root node label shows the total number of PIDs found and the Network Name.

When highlighted, the All PIDs node displays in the detail pane all of the PIDs found in the analyzed stream.

Each of these subordinate nodes contains PIDs belonging to that group. PIDs are allocated during analysis; the number of PIDs is identified for each node. You can also allocate PID numbers to the User PID node; user PIDs may not necessarily have been found in the stream. This feature allows you to compare the properties of one or more PIDs more easily.

The associated summary view provides a PID-oriented overview of the transport stream, allowing you to see the relative data rates of all of the PIDs contained within the transport stream. The information can be displayed as either a bar chart or as a pie chart. Columns in the summary views can be sorted in ascending or descending order by clicking on the column header. PID related information is available under the PID Infromation tab.

Each PID is associated with a number of tests. If one or more tests fail, they will be listed under the relevant PID node in the navigation view. Selecting the PID node will display a summary, in the detail view, of all associated tests that have been found. Selecting a specific test in the Associated Tests pane will display the Event Log and Parameters for that test only.

PID View - Detail View (All PID and Group)

The All PID and PID Group detail view provides you with a PID oriented overview of the transport stream. This view is displayed when any of the main nodes is selected in the navigation pane: All PIDs, Referenced PIDs, Unreferenced PIDs or User PIDs.

The view shows the relative data rates of all of the PIDs contained within the selected node; you can display the information in either a bar chart or a pie format. The associated test states are shown in all views.

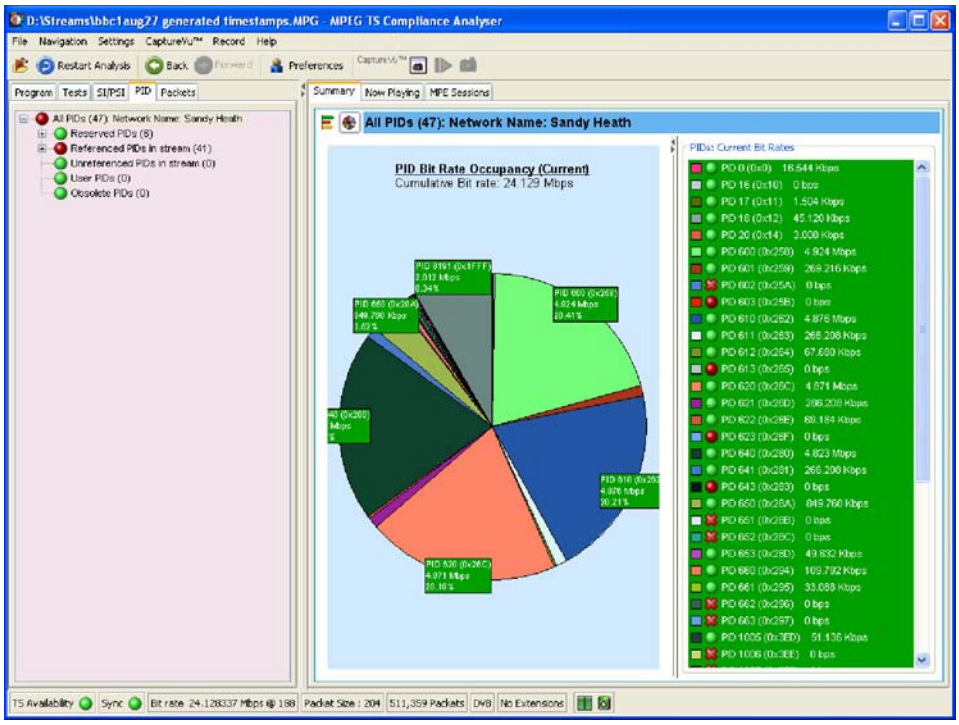

D:\Streams\bbc1aug27 generated timestamps.MPG - MPEG TS Compliance Analyser
File Navigation Settings CaptureVu™ Record Help
Restart Analysis Back Forward Preferences
Program Tests SI/PSI PID Packets
Summary Now Playing MPE Sessions
All PIDs (47): Network Name: Sandy Heath
Reserved PIDs (8)
Referenced PIDs in stream (41)
Unreferenced PIDs in stream (0)
User PIDs (0)
Obsolete PIDs (0)
All PIDs (47): Network Name: Sandy Heath
PID Bit Rate Occupancy (Current)
Cumulative Bit rate: 24.129 Mbps
PIDs: Current Bit Rates
TS Availability Sync Bit rate: 24.128337 Mbps @ 188 Packet Size : 204 511,359 Packets DVB No Extensions

Figure 2-21: PID Summary view

The PID Information view (see Figure 2–22) provides PID related information; for example, PID type stream type, scrambled status and the presence of PCRs. Layer information is also shown when analyzing ISDB streams.

In deferred mode (or during CaptureVu analysis) view the packets carrying a PID by highlighting the PID and selecting Go To Packets view from the context menu; the packet will be added to the PIDs list (in the Packets view).

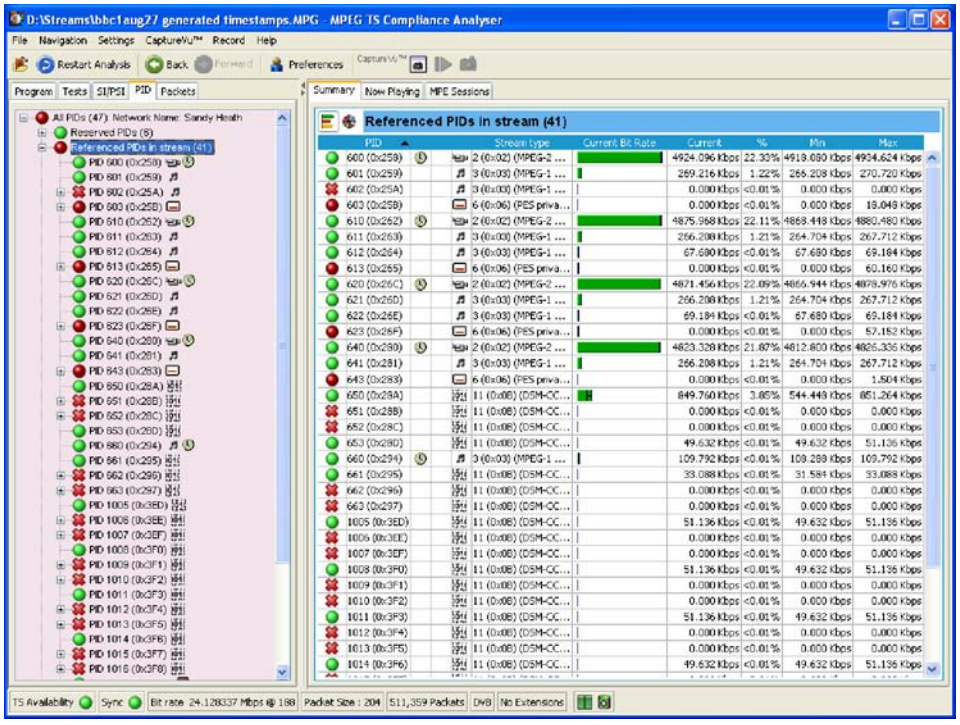

D:\Streams\bbc1aug27 generated timestamps.MPG - MPEG TS Compliance Analyser
File Navigation Settings CaptureVu™ Record Help
Restart Analysis Back Forward Preferences
Program Tests SI/PSI PID Packets
Summary Now Playing MPE Sessions
All PIDs (47) Network Name: Sandy Heath
Reserved PIDs (8)
Referenced PIDs in stream (41)
Referenced PIDs in stream (41)
PID Stream type Current Bit Rate Current % Min Max
TS Availability Sync Bit rate: 24.128337 Mbps @ 188 Packet Size : 204 511,359 Packets DVB No Extensions

Figure 2- 22: PID Information view

PID View - Detail View (PIDs)

The individual PID detail view provides you with information about the selected PID. This view will be visible when you select an individual PID node in the PID tree. Where a PID has failed a test, one or more test nodes are displayed as child nodes of the PID.

The combination and detail of the views varies depending on the selected PID type and node.

During deferred or captured analysis, the packets carrying the PID can be examined in more detail by highlighting a PID and selecting Go to Packets view from the context menu.

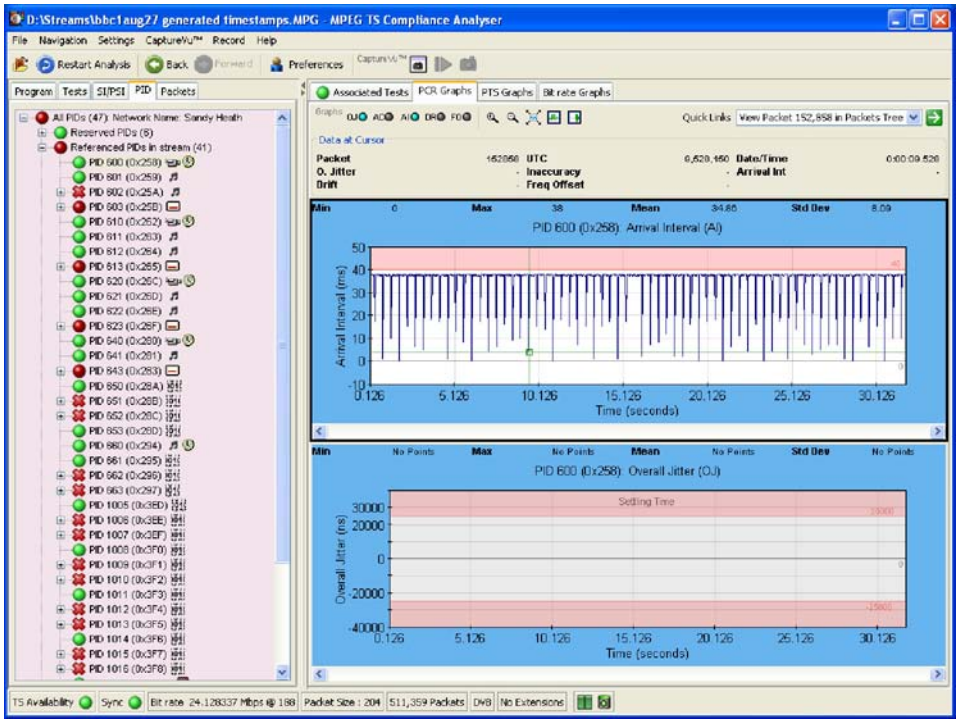
Ordinary PID Selected

When a PID does not contain PCRs, the main view in the PID pane is the Associated Tests view. This view lists the tests associated with the selected PID; the status of the individual tests is indicated with LED icons. Also available are Bit rate Graphs which show in graphical form the bit rate of the selected PID.

Also on the Associated Tests tab is an event log and a parameters pane. The event log shows all PID related events. If a test is selected in the PID pane, only the events associated with that test on that PID are shown. Similarly, when a test is selected, the Parameters pane shows the parameters associated with that test (when applicable).

PCR PID Selected

When the selected PID contains PCR information, PCR inaccuracy and PCR interval data graphs will be displayed in addition to a bit rate graph. When the transport stream contains time stamping data, the PCR overall jitter, the PCR frequency offset and the PCR drift rate graphs will also be available.


D:\Streams\bbc1aug27 generated timestamps.MPG - MPEG TS Compliance Analyser
File Navigation Settings CaptureVu™ Record Help
Restart Analysis Back Preferences
Program Tests SI/PSI PID Packets
Associated Tests PCR Graphs PTS Graphs Bit rate Graphs
Data at Cursor
Packet UTC Date/Time
O. Jitter Inaccuracy Arrival Int
Drift Freq Offset
Min Max Mean Std Dev
PID 600 (0x258): Arrival Interval (AI)
Arrival Interval (ms)
Time (seconds)
PID 600 (0x258): Overall Jitter (OJ)
Overall Jitter (ns)
Time (seconds)
TS Availability Sync Bit rate 24.128337 Mbps @ 188 Packet Size : 204 511,359 Packets DVB No Extensions

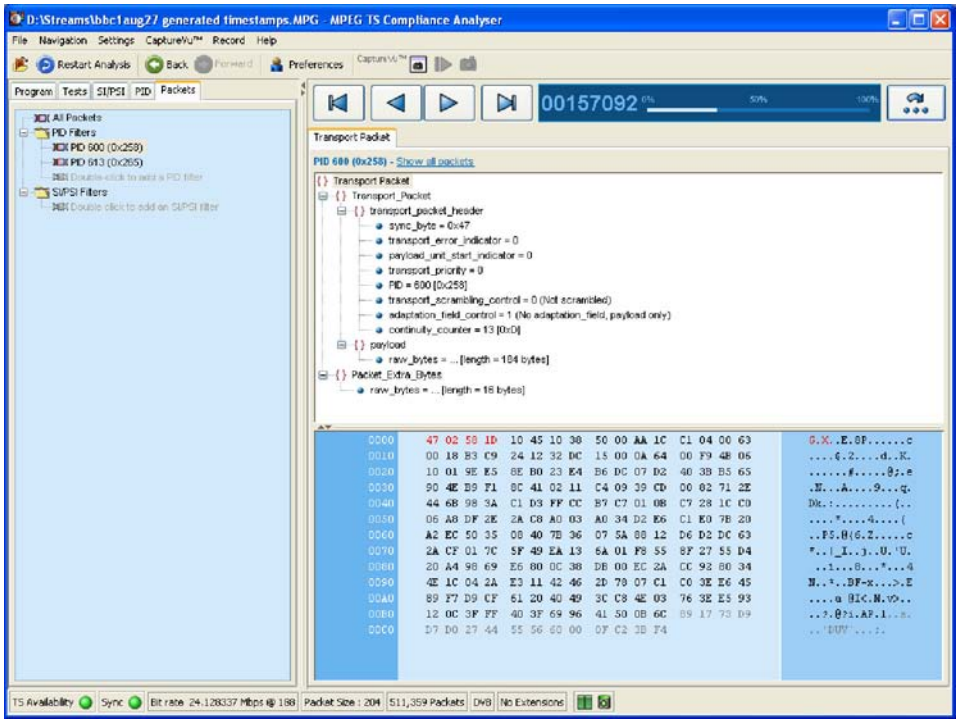
(Refer to *Graph Management*, page 2-68 and *PCR Graphs*, page 2-74.)

A Presentation Time Stamp (PTS) graph may also be available on PIDs carrying audio and video information.

Using the Packets View

***NOTE**. The Packets view is only available during deferred analysis and CaptureVu analysis.*

Data in the stream is carried in 188- or 204-byte packets. The Packets view allows the user to examine the contents of each packet in the analyzed stream.



The packet navigation view shows a tree structure which represents the packets within a stream grouped according to content, including PID value, SFN mega-initialization packets (MIPs) (DVB only) and ISDB-T information packets (IIPs).

The All Packets, MIP and IIP nodes do not have any child nodes. The All Packets node represents all of the packets in the transport stream. The MIP node will represent all of the DVB SFN MIPs in the transport stream. The IIP node will represent all of the ISDB-T information packets in the transport stream.

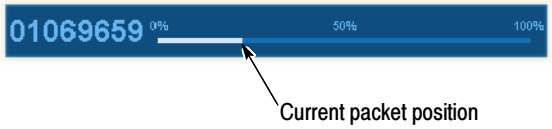
The PIDs node represents all of the PIDs that are of interest. You can add PIDs in the transport stream to this node as well as PIDs that are contained within the user PID list.

Selecting any leaf node in the packet tree will apply a packet filter to the associated packets. For example, selecting a PID node will only allow packets carrying that particular PID to be displayed in the associated summary view; similarly, selecting the MIP node will only allow MIP information to be displayed in the associated summary view.

Packet Navigation Bar

In the packet summary view, you can use the top bar to navigate the packets in the stream.

The packet position bar shows the position of the selected packet in the stream.



The navigation bar functionality depends on the selection in the packet navigation view. If you select All Packets, the controls will operate on all packets. If you select a single PID, a filter is in operation and the controls will work only for those packets carrying that PID.

	Selects the first available packet (in the stream or carrying the selected PID).
	Selects the previous available packet (in the stream or carrying the selected PID).
	Selects the next available packet (in the stream or carrying the selected PID).
	Selects the last available packet (in the stream or carrying the selected PID).
	Opens the Go To Packet dialog box.

You can also use the packet position bar to navigate through the stream. Use the cursor to point to and click the next packet to be displayed. Double-click the packet number in the bar to open the Go To Packet dialog box; enter the required packet number and select OK. For both methods, remember that the destination packet is dependent on the node selected in the navigation view.

Packet Navigation - PIDs node

To inspect the sequence of packets carrying a particular PID, you must add the PID to the PIDs node in the Packet Navigation view. You can add as many PIDs as are required. There are a number of ways to add a PID to the node; they are described in the following paragraphs.

Adding a PID in the Packet View

1. In the Packet view, expand the PIDs node by doing one of the following:
   - Double-click the child node (double-click to add a PID)
   - Select Add PID... from the PIDs node context menu
2. In the Add PID... dialog box, expand the nodes, locate and select the required PID.
3. Click OK.

   The selected PID is added to the PIDs node and that the first occurrence of a packet carrying the selected PID is displayed in the summary view.

Added PIDs will be stored when the application is closed; they will be reinstated when the application is reopened. However, if a different stream is analyzed, the stored PIDs may not be used.

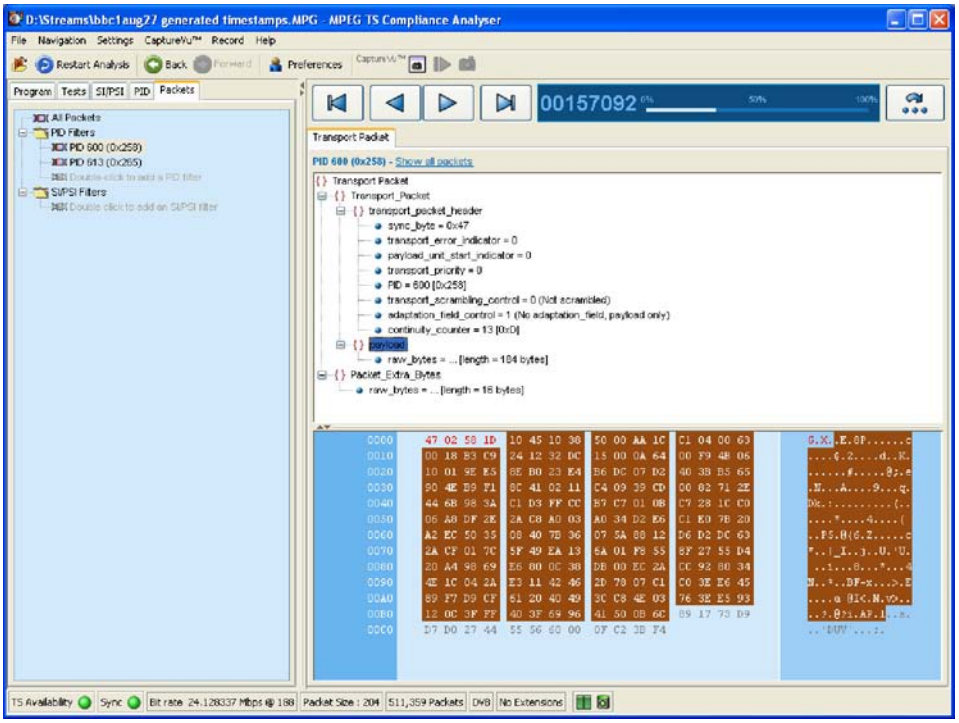
Removing PIDs

All PIDs previously added to the PID node can be removed by selecting Remove All from the PIDs node context menu.

Packet Detail View

The detail view shows the fields and data that are contained in a packet. The fields are arranged in a hierarchical order. The presence of subordinate fields is indicated using a { } symbol adjacent to the container field. To expand or collapse the container, click the + or - icon.

Below the table pane, the data source is displayed. The data pane shows the data bytes (in both hexadecimal number format and ASCII character format) for the selected packet. When you select a node in the table pane, the bytes that make up the selected node (including the subordinate nodes) are highlighted in the hex data pane.



The packet transport header bytes are displayed in red. Similarly, bytes greater than 188 are displayed in gray. The adaptation field, where present, is displayed in blue.

If the section is corrupted or empty, the background of the hex view is red instead of blue.

ISDB Streams

Figure 2-23 and Figure 2-24 show an example of the packet detail view with an analyzed ISDB-T stream. Note the IIP tab and the additional TMCC and IIP nodes.

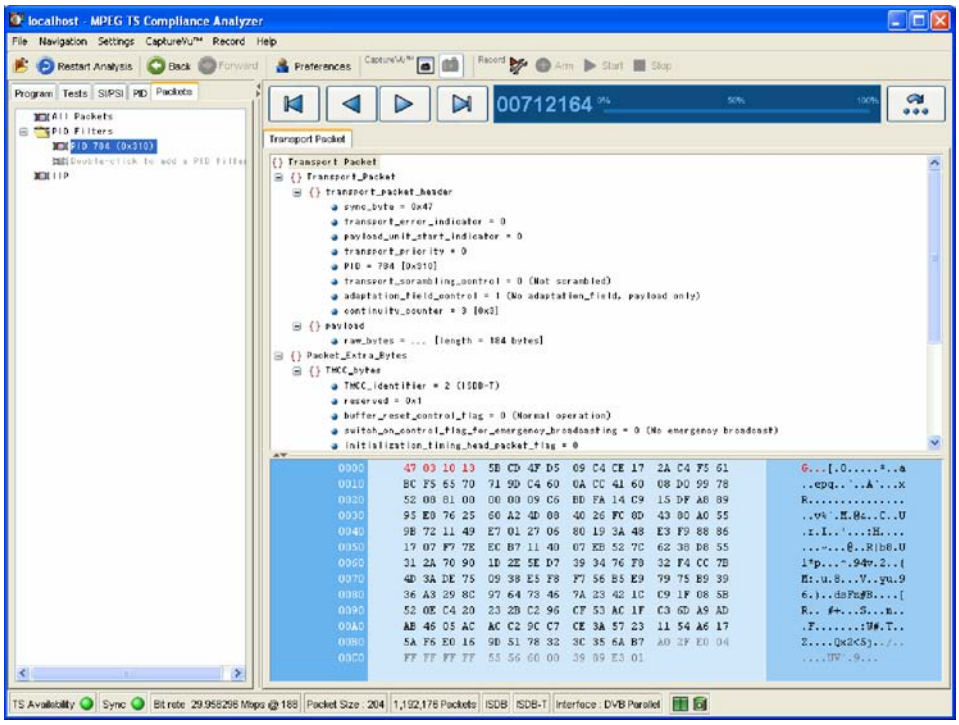


Figure 2-23: Packet view - ISDB detail -IIP

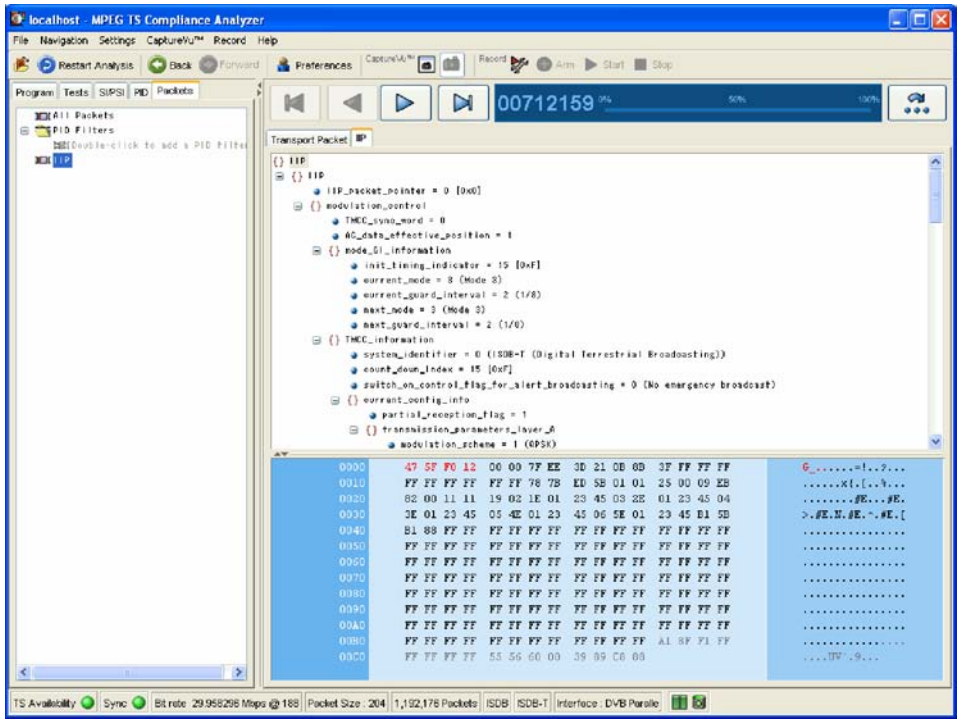

localhost - MPEG TS Compliance Analyzer
File Navigation Settings CaptureVu™ Record Help
Restart Analysis Back Forward Preferences
Program Tests SI/PSI PID Packets
All Packets
PID Filters
TIP
00712159
Transport Packet
TS Availability Sync Bit rate: 29.958296 Mbps @ 188 Packet Size : 204 1,192,178 Packets ISDB ISDB-T Interface : DVB Parallel

Figure 2- 24: Packet view - ISDB detail - Transport packet

Common User Interface Concepts

Many user interface concepts are used throughout the analyzer. The following common elements are described in this section:

- Windows Management
- Icons
- Graph Management
- PCR Graphs
- PTS Graphs
- Bit Rate Graphs
- Parameter Edit
- Event Logs
- Bit Rates
- EPG View
- MPE Views
- CaptureVu™ Features
- Triggered Recording
- Menu Bar and Options
- Preferences
- Script Files

Windows Management

NOTE. *For basic Windows operations such as minimizing windows or using the scroll bars, refer to the MS Windows documentation.*

In addition to the standard windows management methods, the following controls are added which allow the windows panes to be resized.

Horizontal and Vertical Controls

Horizontal and vertical control icons are placed between adjacent panes. Clicking on an icon will expand the adjacent pane in the direction shown by the icon.

The size of panes can also be controlled by placing the cursor over the horizontal or vertical dividing bar so that it changes to a bidirectional arrow. The dividing bar can then be dragged to the required position; an example is shown in Figure 2-25.

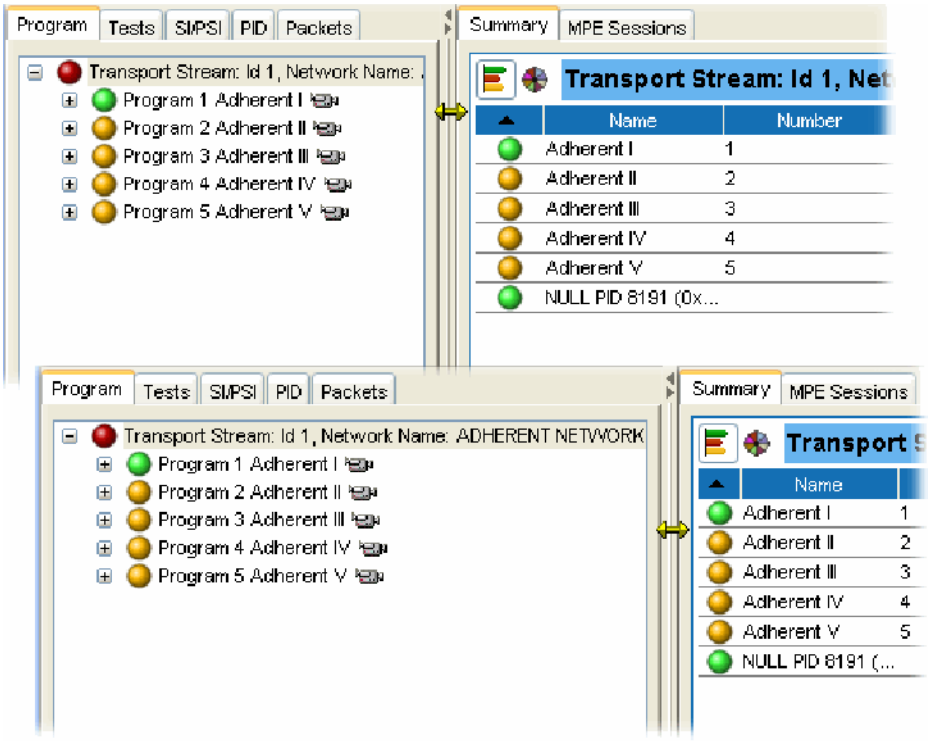


Figure 2-25: Window size adjustments

Table Manipulation

In views such as the PID summary view, which takes the form of a table, the columns can be sorted in ascending or descending order by clicking the section of the header bar on which the table is to be sorted. Similarly, column widths can be adjusted by dragging the column divider bar to the required column width.

Icons

Icons are used in the TSCA to convey information about a node or function.

Table 2–3 and Table 2–4 show the icons used in the TSCA with a brief description of each. Table 2–5 shows the icons used in the quick link section of context (right-click) menus.

***NOTE**. The display of all icons is context dependent. Not all icons will be visible in all views.*

Table 2-3: Object identification icons

Icon	Description
	Application Information Table (MHP)
	Audio
	Conditional Access PID
	Data stream
	Packet
	PCR
	Program
	Programs
	SI table
	SI table container
	SI tables
	Stream scrambled
	Subtitles
	Teletext

Table 2-3: Object identification icons (Cont.)

Icon	Description
	Video
	Video + audio

Table 2-4: Interface management icons

Icon	Description
	Open transport stream
	View CaptureVu settings
	Capture analysis
	Bar Chart
	Pie chart
	Link to
	Preferences
	Audible alarm
	CaptureVu breakpoint
Graph management	
	Hide limits
	Add graph
	Remove graph
	Zoom in
	Zoom out

Table 2-4: Interface management icons (Cont.)

Icon	Description
Packet management	
	Remove all PID packets
	Remove PID packet
	Add PID packet
	PID packet group
	PID packet placeholder
	Go to first packet
	Go to previous packet
	Go to next packet
	Go to last packet
	Open Go To Packet dialog box
Action control	
	Go to previous view
	Go to next view

Table 2-5: Quick link icons

Icon	Description
	Go to next red LED in current tree
	View this PID in PID tree
	View packets with this PID
	View packets in Packet tree
	View PCR graphs

Table 2-5: Quick link icons (Cont.)

Icon	Description
	View this program's PMT in SI tree
	View this test in Tests tree

Graph Management

A number of screens displaying graphs are available in the analyzer. The graphs are described in the relevant sections of this manual. This section describes the management of the graphs user interface.

A number of categories of graphs are available.

Four categories of graph exist: those relating to PCR measurements, section timing, bit rates and PTS (Presentation Time Stamps).

The PCR measurement graphs include:

- PCR Drift
- PCR Inaccuracy
- PCR Arrival Interval
- PCR Frequency Offset
- PCR Jitter

The section timing graphs include:

- Section Repetition Interval
- Subtable Inter Section Gap
- Subtable Repetition Interval

The category of graph displayed depends on the selection made in the navigation view. Categories include PCR Measurement, Section Timing, PTS (Presentation Time Stamp) and Bit Rate. However, the menus and options for the graphs are similar and as described in the following pages.

Measurement Background

Measurement points (2048 maximum) are held in a circular buffer.

***NOTE**. A circular buffer is an area of memory used to store a continuous stream of data by starting again at the beginning of the buffer after reaching the end.*

A graph set for full display will show the current measurement points. During real-time analysis, the graph is constantly being filled (from the right to left); measurements moving off the left side of the display are lost. The time scale (Y-axis) is started from zero each time that the node is accessed.

For some of the graphs, sufficient data must be gathered before meaningful results can be displayed. The word “Settling Time” will be displayed briefly in the graph area while the necessary data is gathered.

Overview

Figure 2–26 shows a typical graph display; in this case a PID carrying PCR has been selected and two of the five available PCR graphs are displayed.

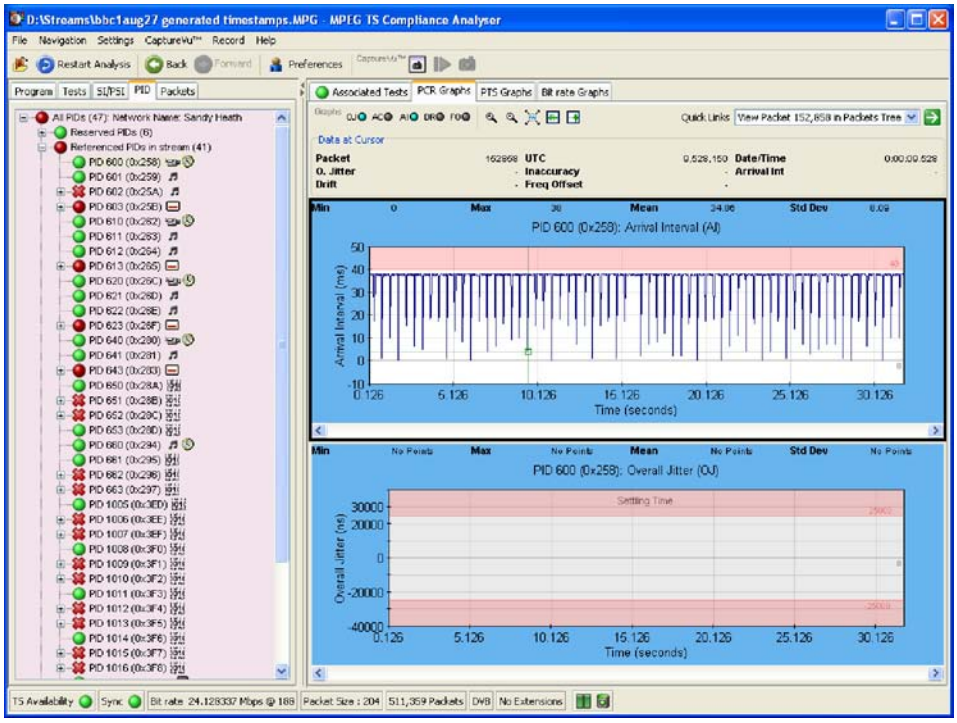

D:\Streams\bbc1aug27 generated timestamps.MPG - MPEG TS Compliance Analyser
File Navigation Settings CaptureVu™ Record Help
Restart Analysis Back Forward Preferences
Programs Tests SI/PSI PID Packets
Associated Tests PCR Graphs PTS Graphs Bit rate Graphs
Quick Links
Data at Cursor
Packet UTC Date/Time
PID 600 (0x258): Arrival Interval (AI)
Arrival Interval (ms)
Time (seconds)
PID 600 (0x258): Overall Jitter (OJ)
Overall Jitter (ns)
Setting Time
Time (seconds)
TS Availability Sync Packet Size : 204 DVB No Extensions

Figure 2-26: PCR graphs

Within the category, the x axis is common to the all graphs. A horizontal scroll bar allows you to select an area for inspection when the graph extends beyond the display area.

The y axis initially shows the measurement limits (both upper and lower where appropriate). Limits are set from the Tests view (see page 2–39). The area outside the limits is shaded (red); the shading can be hidden if required using the graph context menu. The Y axis is rescaled to show the maximum and minimum data points.

Cursor Data and Control

A cursor can be displayed on the graphs allowing you to see accurate measurements in the adjacent data panel. Place the cursor by left-clicking any data point on one of the graphs. Note that the cursor is displayed at the same point on all of the visible graphs.

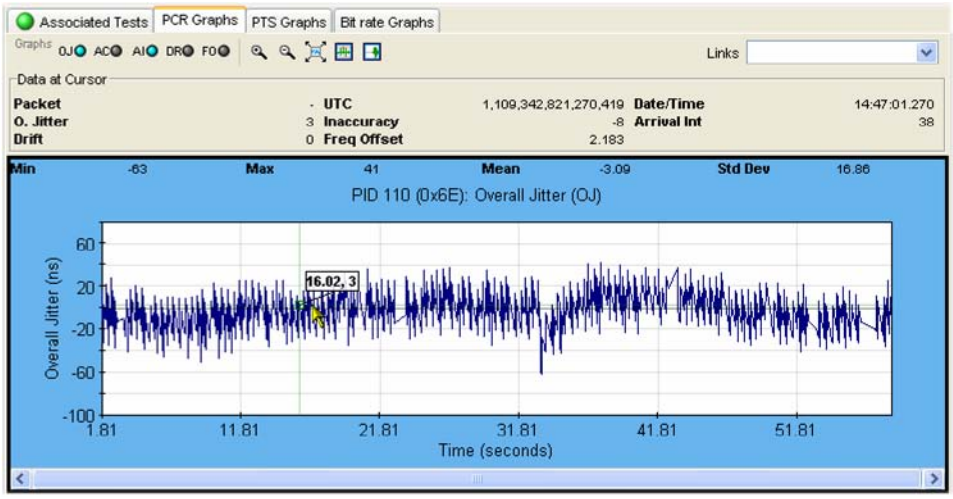


Figure 2-27: Graphs - cursor

A tooltip is displayed when the point is selected giving the X and Y coordinates of the point; the values of these will vary depending on the graph.

Data associated with the selected point will also be displayed in the graph's statistics panel (at the top of each graph). The displayed values (maximum, minimum, mean and standard deviation) are calculated for all of the data that is received while the navigator node is highlighted.

Similarly, data for all graphs is displayed in the Data at Cursor panel. Also displayed is a link to the packet carrying the PCR.

The cursor can be moved either by clicking a new position on the graph or one point at a time by using the left or right controls on the keyboard.

Graph Menu and Toolbar

The Graph Toolbar allows graph displays to be toggled on and off and graph controls (see Figure 2–27).

At the left end of the toolbar, adjacent to the Graphs: toggle-action buttons for the available graphs are displayed. The buttons displayed (and hence, the available graphs) will vary according to the information carried in the stream and the measurements enabled.

Select a button to display the associated graph. The following abbreviations are used:

AI	Arrival Interval
OJ	Overall Jitter
AC	Inaccuracy
DR	Drift Rate
FO	Frequency Offset

(See *PCR Graphs*, page 2–74 for an explanation of the graphs.)

The remaining graph controls are as follows:

Zoom in

Zoom out

Return graphs to full scale display
(All graphs can be returned to full display by double-clicking anywhere in the graph display area.)

Hide/show measurement limits

Hide/show settling time

The graph right-click menu can be displayed by right-clicking anywhere in a graph display area. The options on the menu are applicable to only the graph from which the menu was selected.

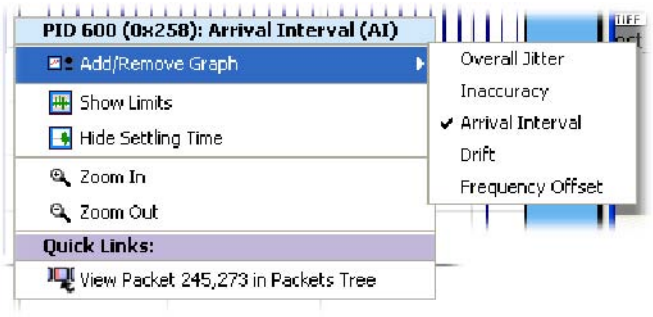


Figure 2-28: Graph Right-click menu

The title bar displayed at the top of the menu shows which object the graph applies to (for example, PID 610).

Adding and Removing Graphs

Graphs can be added to and removed from the graph display by clicking Add Graph or Remove Graph on the graph right-click menu or toolbar; the graph will be added below the currently selected graph. Each graph type can only be displayed once.

Hide Limits

Each graphed measurement has limits set either by default (derived from the stream interpretation standard) or as modified by the user (see *Parameter Edit*, page 2–81). If the limit is exceeded, an error is flagged elsewhere.

The limits set are displayed as shaded areas on the graphs. The graph will be initially scaled to include the limit values.

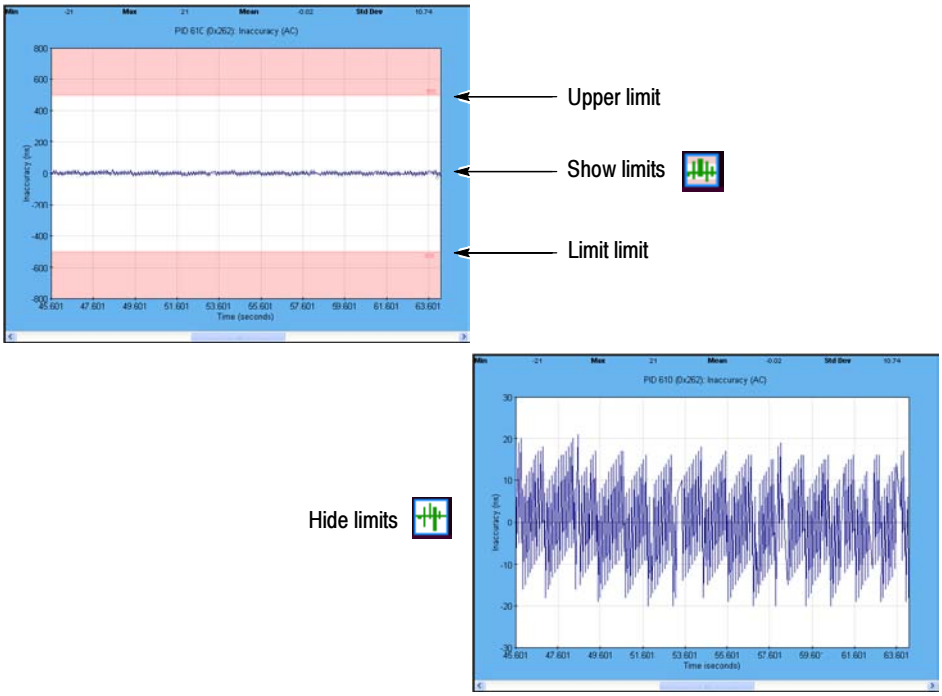


Figure 2-29: Figure 2-1: Limits display

Hide/show the limits by selecting Hide Limits/Show Limits on the graph right-click menu or toolbar. When the limits are hidden, the graph is rescaled between the maximum and minimum Y values.

Settling Time

Some of the graphs in the TSCA require a number of samples to be available before meaningful results can be displayed. The period during which sufficient samples are being gathered is referred to as the settling time. During this settling time, the graph is grayed out and displays the word Settling Time.

Zoom Feature

You can zoom graphs in and out using the controls on the menu bar or from the Graph Menu. An area of a graph can also be expanded by holding the right mouse button and dragging a rectangle around the required area.

Zooming action (in or out) is centered on the center point of the graph, irrespective of the cursor position. Both axes are expanded/contracted to accommodate the revised display. The graph is expanded or contracted by 25% of the displayed area each time that the control is used. Double-clicking on a graph rescales the axes to show the complete plotted data set.

If the shift key is held while the zoom control is clicked, the Y axis is locked, while the X axis is expanded or contracted.

If the control key is held while the zoom control is clicked, the X axis locked, while the Y axis is expanded or contracted.

During real-time analysis expanding (zooming in) on an area of a graph generates a static snapshot of the graph. Because of the way that the measurements are stored in the circular buffer, the display will eventually clear; the only way to redisplay the graph is to return to full-scale display.

PCR Graphs

Table 2–6 shows the measurement graphs that are available for PIDs carrying PCRs. If a PCR PID is also carrying time stamp information, the full set of graphs will be available.

The graphs available will depend whether the PID is carrying PCR and/or time stamp (TS) information.

Table 2- 6: PCR measurement graphs

Graph Type	PID + PCR	PID + PCR + TS
PCR Inaccuracy	✓	✓
PCR Arrival Interval	✓	✓
PCR Drift Rate	-	✓
PCR Frequency Offset	-	✓
PCR Overall Jitter	-	✓

Descriptions follow of each of the measurements. Adjustments can be made to each of the measurement parameters.

If the interval exceeds the limits displayed on the screen, the scale is adjusted automatically as necessary to include the maximum displayed values.

***NOTE**. As with other parameter value adjustments, it is important to note where the adjustment is being made from. If the adjustment is made with a test node highlighted, all PIDs will be measured against that value. If the adjustment is made with a PID highlighted, only that PID will be measured against the modified value.*

PCR Inaccuracy (PCR_AC)

The PCR Inaccuracy graph shows the difference between the actual and expected values for each PCR on the y-axis. Expected PCR values are calculated from the byte index of the PCR.

The default limits are set ±500 ns.

The Maximum PCR Accuracy Error limit can be adjusted by modifying the Max PCR accuracy error.

PCR Arrival Interval

The PCR Arrival Interval graph provides a display of the time interval between successive PCRs, during the last 256 PCRs. The interval is displayed on the y-axis. The default limit (Maximum Repetition Period set in ETR 101 290 test 2.3) is 40 ms.

The PCR Maximum Repetition Interval limit can be adjusted by modifying the PCR max repetition interval.

PCR Drift Rate (PCR_DR)

This Drift Rate graph shows the rate of change of PCR Frequency Offset, which is often very small. It is calculated using PCR Frequency Offset measurements.

The maximum PCR Drift Rate limit can be adjusted by modifying the Max PCR frequency drift rate parameter.

PCR Frequency Offset (PCR_FO)

The Frequency Offset graph shows the difference between the program clock frequency and the nominal clock frequency (measured against a reference that is not PCR or transport stream derived).

PCR Frequency Offset is a measurement of the error in the PCR frequency from the specified 27 MHz; the MPEG specification sets the limits at ±810 Hz.

The Maximum PCR Frequency Offset limit can be adjusted by modifying the Max PCR frequency offset parameter.

PCR Overall Jitter (PCR_OJ)

The PCR Overall Jitter graph shows the time interval between the actual value of the PCR and its expected value based on its arrival time.

The Maximum PCR Accuracy Error limit can be adjusted by modifying the **Max PCR overall jitter** parameter.

MTS400 PCR Measurements and Settling Time

Demarcation Frequency. The PCR measurements provided by the MTS400 Transport Stream Compliance Analyzer are defined by TR 101 290. Appendix I of TR 101 290 describes the measurements in detail, and also introduces the concept of the "demarcation frequency" at which PCR errors are separated into drift errors or jitter errors. Errors below the demarcation frequency are measured as drift, while errors above that frequency are measured as jitter.

TR 101 290 also defines three standard demarcation frequencies, MGF1 (10 MHz), MGF2 (100 MHz) and MGF3 (1 Hz) at which the PCR measurements can be made, and provides for a user-definable demarcation frequency, MGF4. The TSCA extends this concept slightly, by providing two editable parameters, one controlling the frequency below which errors are measured as drift (PCR_FO/DR low-pass filter cut-off frequency), and one for the frequency above which errors are measured as jitter (PCR_OJ/AC high-pass filter cut-off frequency). Both of these parameters can be set at any frequency between 1 MHz and 10 Hz, which encompasses all of the standard MGF profiles.

To change these values, select Settings > Parameters... from the menu bar, scroll to the appropriate parameters and make the required changes.

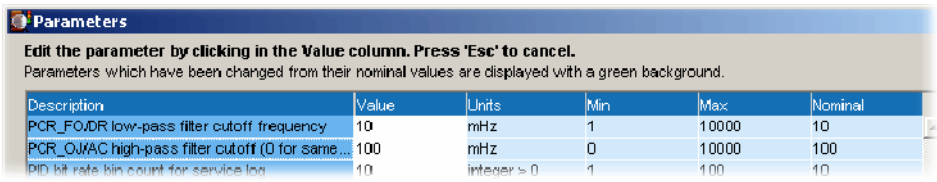


Figure 2- 30: PCR parameters - Filter settings

Please note that the TR 101 290 drift limit of ±75 MHz/s is only defined at a demarcation frequency of 10 MHz. As the low-pass filter frequency is increased above that value, more of the PCR jitter will be measured as drift, and so the measured drift values will increase. If you are attempting to check that your source PCR clock is compliant with the TR 101 290 limits, the low-pass filter cut-off frequency should be set to 10 MHz.

Settling Time. All of the PCR measurements that depend on demarcation filters (PCR_DR, PCR_FO, PCR_OJ, and PCR_AC) have a settling time. The measurements will not give valid values before this time. The settling time is indicated on the PCR graphs in the TSCA.

This settling time is inversely proportional to the cut-off frequency of the demarcation filter; so there is a trade-off between reducing the filter frequency to improve drift measurement accuracy and increasing the time it takes to obtain any drift measurements at all.

Table 2- 7: PCR settling times

Filter cut-off	Settling Time	TR101-290 Profile	Comments
10 MHz	500 s	MGF1	TSCA default for PCR_FO/ DR low-pass filter cut-off. Drift limit of ±75 MHz/s is only applicable at this level.
100 MHz	50 s	MGF2	TSCA default for PCR_FO/ DR low-pass filter cut-off. Drift limit of ±75 MHz/s is only applicable at this level.
1000 MHz (1Hz)	5 s	MGF3	-
1 MHz - 10,000 MHz	5000 s – 0.5 s	MGF4	User-defined profile

PTS Graphs

Presentation Time Stamps (PTS) indicate the exact moment where a video frame or an audio frame has to be decoded or presented to the user respectively. The PTS graphs show the PTS arrival intervals.
(See also *Graph Management*, page 2–68.)

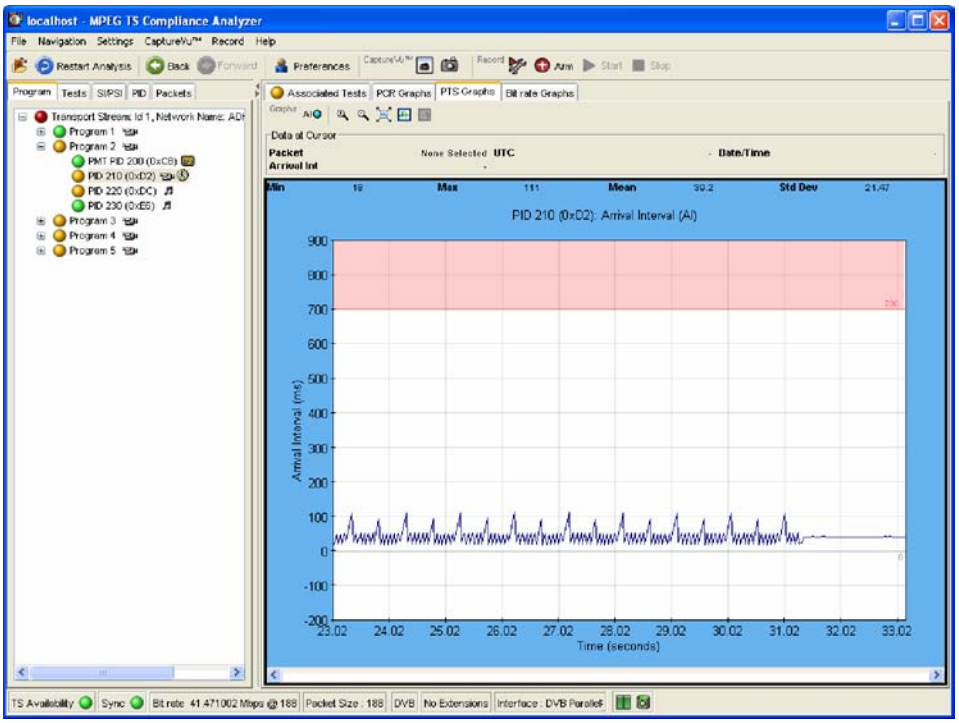


Figure 2-31: PTS graph - limits on

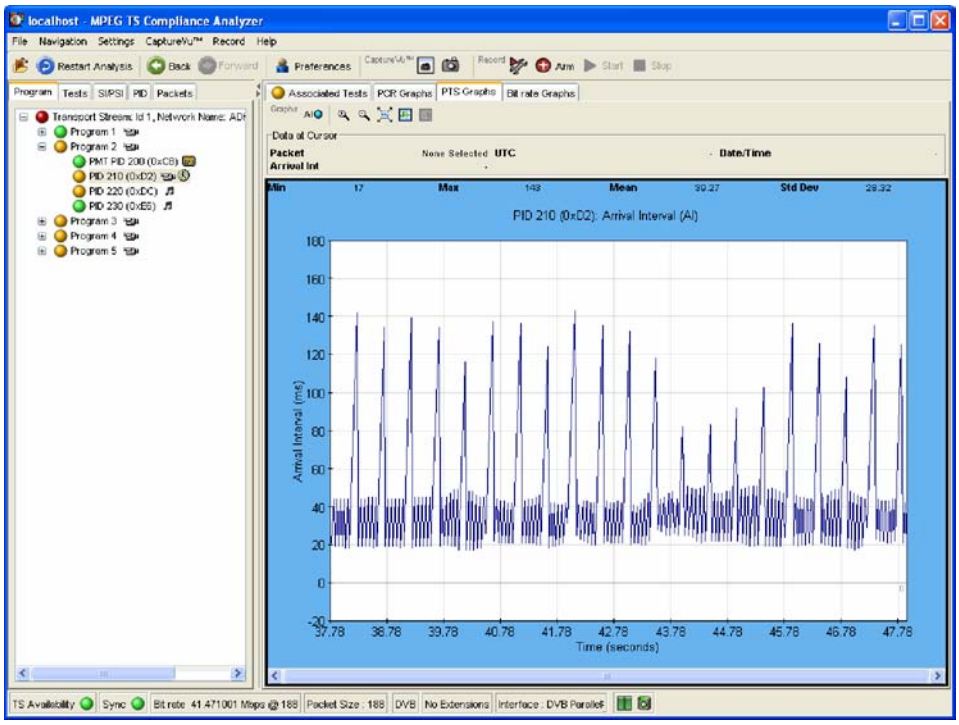


Figure 2-32: PTS graph - limits off

Bit Rate Graphs

Bit rate graphs are available on program and PID nodes.
(See also *Graph Management*, page 2–68.)

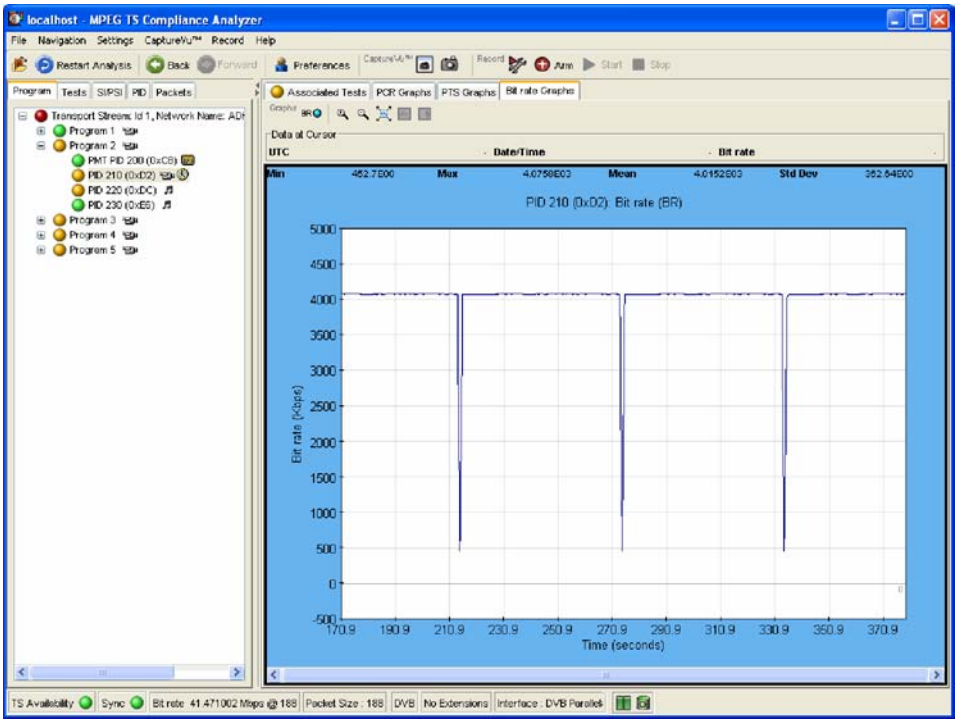


Figure 2- 33: Bit rate graph

Parameter Edit

The error states displayed on the user interface are each the result of making one or more measurements or tests on the analyzed transport stream. The displayed tests are derived from the selected interpretation standard. Additional proprietary tests are also included.

Some measurements and tests translate directly to an error state; others are the result of a combination of tests. For many of the tests, you can affect the result by varying parameters that influence the test result, for example, maximum and minimum bit rate values, although the test result may not then conform to the chosen interpretation standard.

Figure 2–34 shows the parameters that are available for the ETR 101 290 test 2.5.
Figure 2–35 shows the parameters that are available for a single PID under ETR 101 290 test 2.5. Not all parameters applied to a test are necessarily applied to a PID.

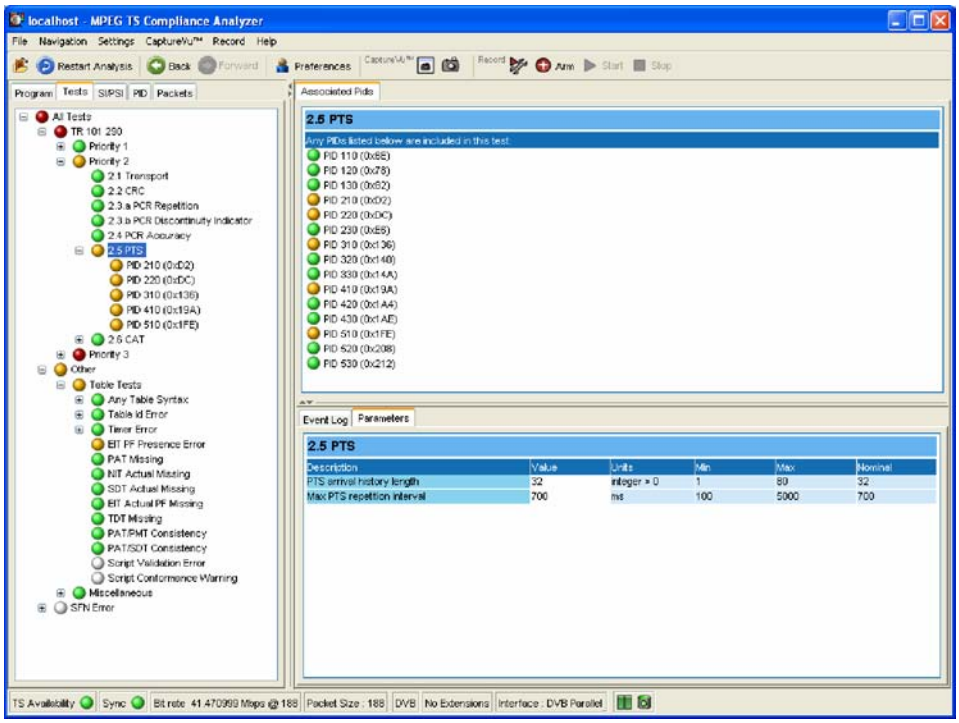


Figure 2- 34: Test parameters

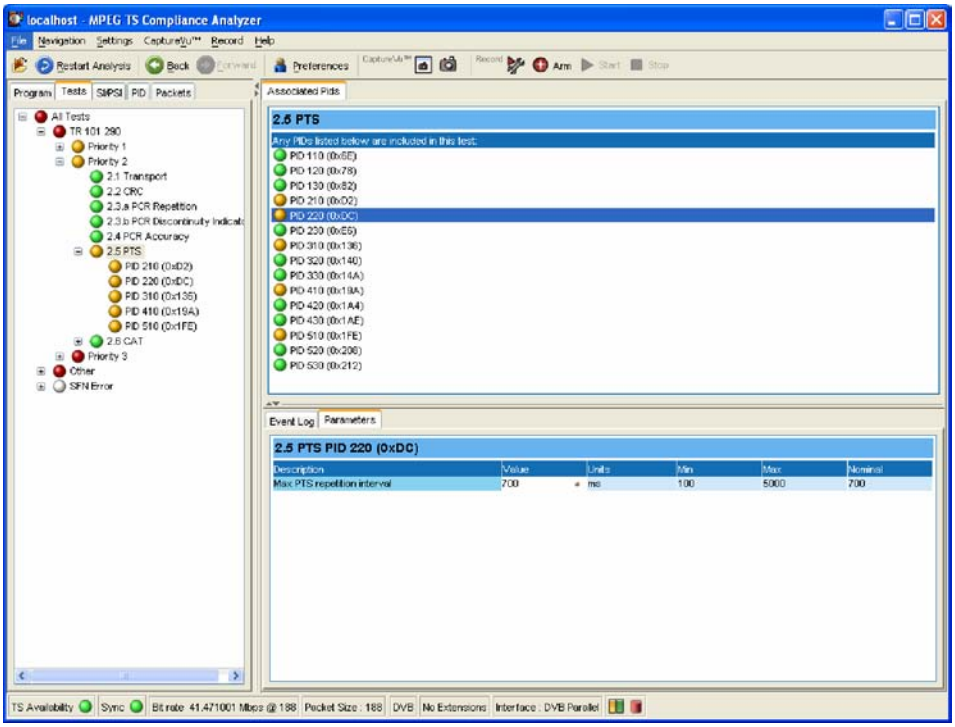


Figure 2-35: PID test parameters

Each test parameter entry includes the following fields:

- Description of parameter.
- Value - the current setting. If the setting is the same as the nominal value, an icon will also be displayed in this field.
- Units in which the measurement is made.
- Maximum and minimum values. These are the maximum and minimum values recommended by the standard selected.
- Nominal value. This is the value or setting recommended by the interpretation standard selected.

It is important to understand the difference between default and nominal values.

If a parameter value is set for a test, it becomes the default value for the test and hence for all PIDs subject to that test. PIDs using the default value will have bullet icon is displayed in the Value field (see Figure 2-36).

Figure 2-36: Parameter value - default icon

However, you can also set individual PID parameter values; the value set is applied to only that PID, not to the other PIDs using the same test or the test default value.

The nominal value is provided by the interpretation standard; it cannot be changed using the user interface.

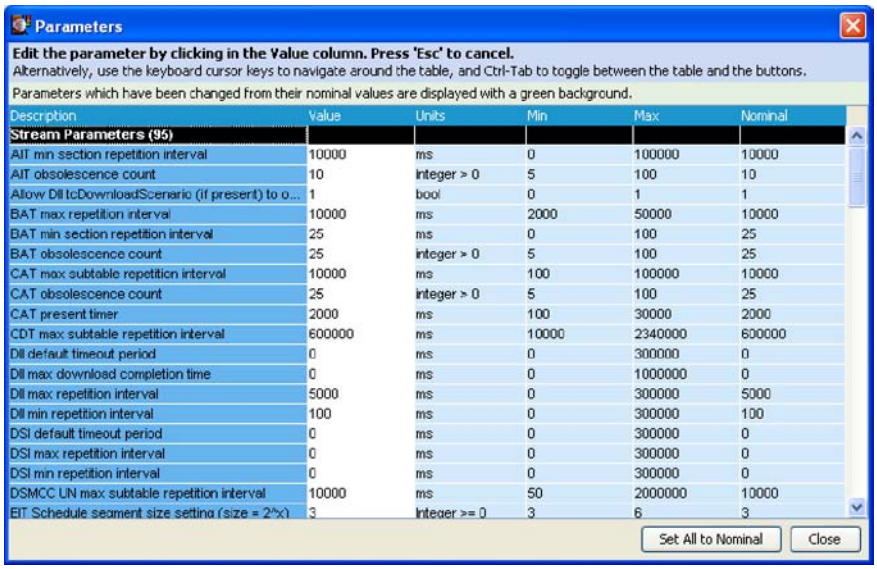
Changing a test parameter value

1. Click in the Value field.
2. Enter the required value.
3. Press Enter.

***NOTE**. For a new value to take effect during deferred analysis, the stream must be closed. Select* Restart Analysis *to open and reanalyze the stream.*

Access to all parameters

All parameters are accessible from the Parameters menu option (Settings > Parameters…). Parameter values can be changed in the same way as individual parameters. Changes made to values in this dialog box are also applied to the individual PID parameters, since changes made here become the default value for the parameter.


Parameters
Edit the parameter by clicking in the Value column. Press 'Esc' to cancel.
Alternatively, use the keyboard cursor keys to navigate around the table, and Ctrl-Tab to toggle between the table and the buttons.
Parameters which have been changed from their nominal values are displayed with a green background.
Description
Value
Units
Min
Max
Nominal
Stream Parameters (95)
AIT min section repetition interval 10000 ms 0 100000 10000
AIT obsolescence count 10 integer > 0 5 100 10
Allow DII tcDownloadScenario (if present) to o... 1 bool 0 1 1
BAT max repetition interval 10000 ms 2000 50000 10000
BAT min section repetition interval 25 ms 0 100 25
BAT obsolescence count 25 integer > 0 5 100 25
CAT max subtable repetition interval 10000 ms 100 100000 10000
CAT obsolescence count 25 integer > 0 5 100 25
CAT present timer 2000 ms 100 30000 2000
CDT max subtable repetition interval 600000 ms 10000 2340000 600000
DII default timeout period 0 ms 0 300000 0
DII max download completion time 0 ms 0 1000000 0
DII max repetition interval 5000 ms 0 300000 5000
DII min repetition interval 100 ms 0 300000 100
DSI default timeout period 0 ms 0 300000 0
DSI max repetition interval 0 ms 0 300000 0
DSI min repetition interval 0 ms 0 300000 0
DSMCC UN max subtable repetition interval 10000 ms 50 2000000 10000
EIT Schedule segment size setting (size = 2^x) 3 Integer >= 0 3 6 3
Set All to Nominal
Close

Select the Set All to Nominal button to return all parameter values to their factory settings. During deferred analysis, the current stream will need to be closed and reopened (reanalyzed) for the new parameter settings to take effect.

Event Log

The event log displays a history of events related to a selected item. When no log is available, the message “No log entries were found” is displayed. In a log, events are placed in chronological order (with the most recent at the top).

Event log displays are context dependent; the view and object that is currently selected will dictate the content of the associated log. For example, with the transport stream node selected in the Programs navigation view, the associated event log displays all events. Similarly, with a single PID selected, the associated event log only displays events relevant to that PID. Exported logs are similarly context dependent; only currently displayed events will be exported.

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Event Log Control

The event log will normally display the most recent event at the top of the log. Past events will be scrolled down the screen; not all of these event entries can be viewed on a single screen, even in a maximized Log View window.

If events are constantly being generated, an event entry may pass out of view before you have had a chance to examine it.

However, if you scroll down to view a past event, the viewing window will remain fixed on that entry, even though events entries are still being added at the top of the log view. Evidence of this is shown by the scroll box continuing to advance towards the bottom of the screen.

The event entry being viewed will eventually move to the bottom of the event log. At this point the entry will be lost and the view will return to the most recent entries at the top of the screen; automatic scrolling will recommence.

Event Log Pinning

Another way of viewing a single event in a stream of log events is by pinning the log. By pinning the log, you are taking a snapshot of the log at a particular moment in time; you can then move up and down the pinned log as required. Newly generated events will continue to be generated but will not be displayed until the log is unpinned.

You can pin the log by selecting the Pin icon or **Pin Log** from the right-click menu.

	Shows that log is not pinned. Select to pin log.
	Shows that the log is pinned. Select to unpin log.

When the log is pinned it is displayed against a blue background and the pin icon is changed.

Note that pinning the log may take a few seconds; the whole log is saved, that is, up to 1000 entries.

The log will remain pinned until you select the Pin icon or display another TSCA view.

Exporting the Event Log

You can export the log (pinned or unpinned) in either XML or CSV format.

You can export the log by selecting the Export icon or Export Log from the right-click menu.

Select the format in which the log file is to be saved, either xml or csv, and a location for the file.

Color-Coding Events

Specific event types can be color-coded in the display to allow them to be identified more easily (as shown in Figure 2–37). Color-coding can be done from any event log display. The color-coding dialog box is available from the event log context menu.

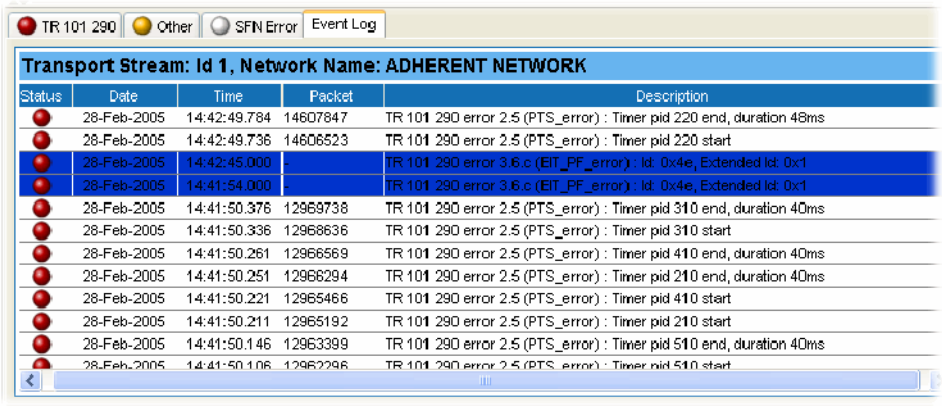

TR 101 290
Other
SFN Error
Event Log
Transport Stream: Id 1, Network Name: ADHERENT NETWORK
Status
Date
Time
Packet
Description
28-Feb-2005 14:42:49.784 14607847 TR 101 290 error 2.5 (PTS_error) : Timer pid 220 end, duration 48ms
28-Feb-2005 14:42:49.736 14606523 TR 101 290 error 2.5 (PTS_error) : Timer pid 220 start
28-Feb-2005 14:42:45.000 - TR 101 290 error 3.6.c (EIT_PF_error) : Id: 0x4e, Extended Id: 0x1
28-Feb-2005 14:41:54.000 - TR 101 290 error 3.6.c (EIT_PF_error) : Id: 0x4e, Extended Id: 0x1
28-Feb-2005 14:41:50.376 12969738 TR 101 290 error 2.5 (PTS_error) : Timer pid 310 end, duration 40ms
28-Feb-2005 14:41:50.336 12968636 TR 101 290 error 2.5 (PTS_error) : Timer pid 310 start
28-Feb-2005 14:41:50.261 12966569 TR 101 290 error 2.5 (PTS_error) : Timer pid 410 end, duration 40ms
28-Feb-2005 14:41:50.251 12966294 TR 101 290 error 2.5 (PTS_error) : Timer pid 210 end, duration 40ms
28-Feb-2005 14:41:50.221 12965466 TR 101 290 error 2.5 (PTS_error) : Timer pid 410 start
28-Feb-2005 14:41:50.211 12965192 TR 101 290 error 2.5 (PTS_error) : Timer pid 210 start
28-Feb-2005 14:41:50.146 12963399 TR 101 290 error 2.5 (PTS_error) : Timer pid 510 end, duration 40ms

Figure 2-37: Event log - color coding

1. Highlight the event type and select Color from the context menu (see Figure 2–38).

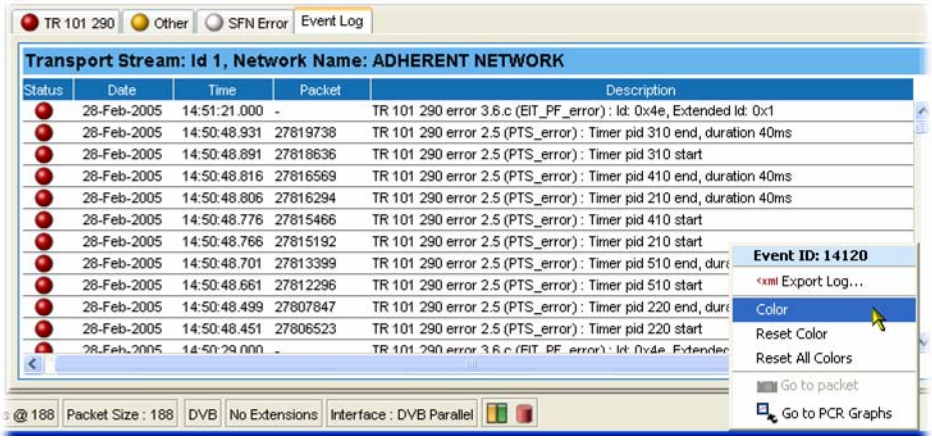

TR 101 290
Other
SFN Error
Event Log
Transport Stream: Id 1, Network Name: ADHERENT NETWORK
Status
Date
Time
Packet
Description
28-Feb-2005 14:51:21.000 - TR 101 290 error 3.6.c (EIT_PF_error) : Id: 0x4e, Extended Id: 0x1
28-Feb-2005 14:50:48.931 27819738 TR 101 290 error 2.5 (PTS_error) : Timer pid 310 end, duration 40ms
28-Feb-2005 14:50:48.891 27818636 TR 101 290 error 2.5 (PTS_error) : Timer pid 310 start
28-Feb-2005 14:50:48.816 27816569 TR 101 290 error 2.5 (PTS_error) : Timer pid 410 end, duration 40ms
28-Feb-2005 14:50:48.806 27816294 TR 101 290 error 2.5 (PTS_error) : Timer pid 210 end, duration 40ms
28-Feb-2005 14:50:48.776 27815466 TR 101 290 error 2.5 (PTS_error) : Timer pid 410 start
28-Feb-2005 14:50:48.766 27815192 TR 101 290 error 2.5 (PTS_error) : Timer pid 210 start
28-Feb-2005 14:50:48.701 27813399 TR 101 290 error 2.5 (PTS_error) : Timer pid 510 end, dur
28-Feb-2005 14:50:48.661 27812296 TR 101 290 error 2.5 (PTS_error) : Timer pid 510 start
28-Feb-2005 14:50:48.499 27807847 TR 101 290 error 2.5 (PTS_error) : Timer pid 220 end, dur
28-Feb-2005 14:50:48.451 27806523 TR 101 290 error 2.5 (PTS_error) : Timer pid 220 start
Event ID: 14120
Export Log...
Color
Reset Color
Reset All Colors
Go to packet
Go to PCR Graphs
@ 188
Packet Size : 188
DVB
No Extensions
Interface : DVB Parallel

Figure 2-38: Event log - context menu - color

Figure 2–39 shows the Color dialog box.

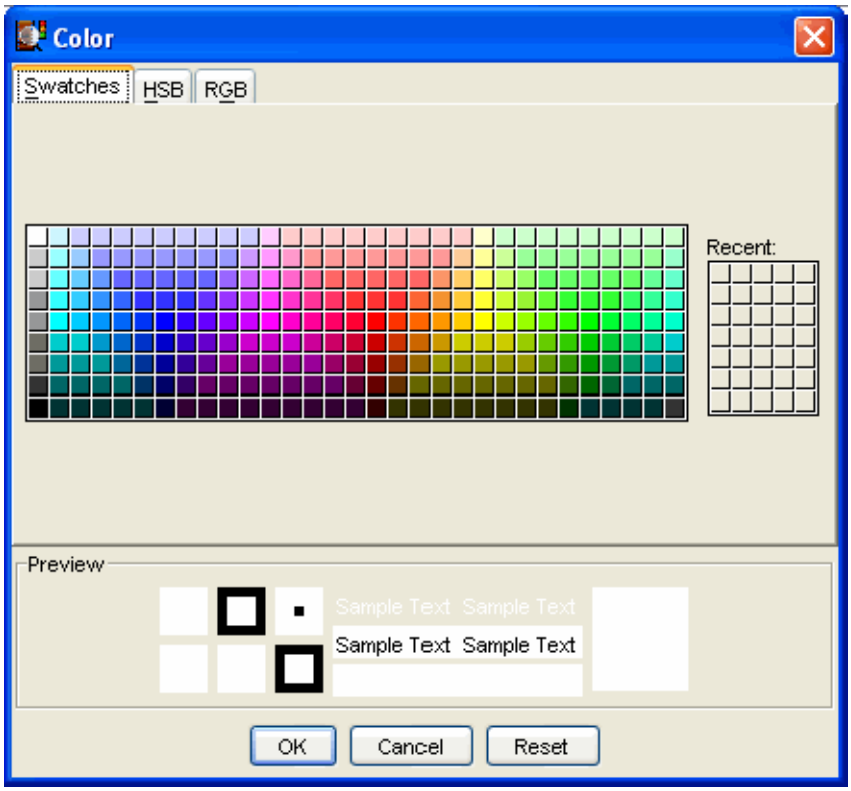


Figure 2- 39: Event log - color dialog boxes

2. Select the primary display color.

   The color can be specified from the Swatch tab. It can also be specified in HSB (Hue, Saturation, Brightness) or RGB (Red, Green, Blue) terms by selecting the appropriate tab and entering the required values.

3. Select OK. All events of the same type are now highlighted in the selected color.

The color-coding on a single event type can be removed by selecting Reset Color from the Event Log context menu. Color-coding can be removed from *all* event types by selecting Reset All Colors from the context menu.

Bit Rates

In a stream, bit rates are calculated and displayed for the following:

- Transport stream
- Programs
- PIDs

The display choices (bar chart or pie chart) and management of the display are similar for each type.

Select the appropriate icon to switch charts:

Bar Charts

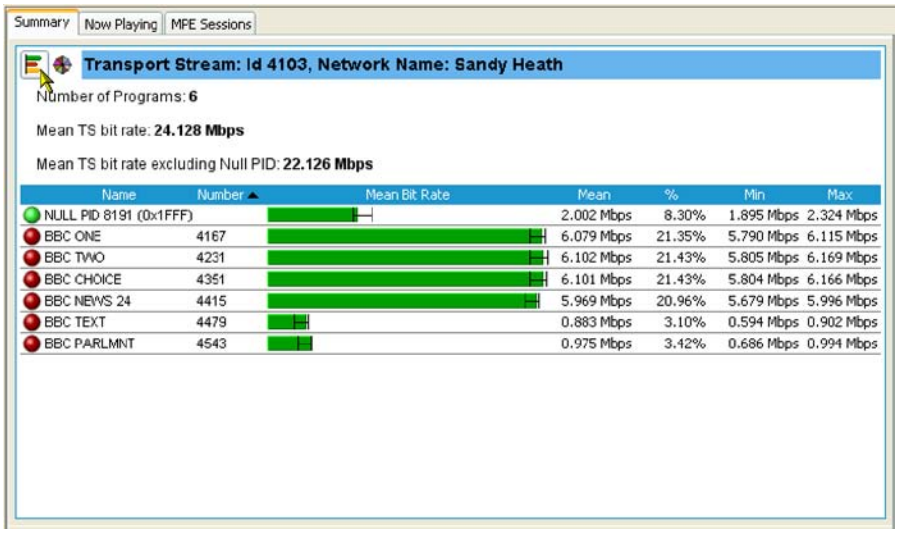

Summary
Now Playing
MPE Sessions
Transport Stream: Id 4103, Network Name: Sandy Heath
Number of Programs: 6
Mean TS bit rate: 24.128 Mbps
Mean TS bit rate excluding Null PID: 22.126 Mbps
Name
Number
Mean Bit Rate
Mean
%
Min
Max
NULL PID 8191 (0x1FFF) 2.002 Mbps 8.30% 1.895 Mbps 2.324 Mbps
BBC ONE 4167 6.079 Mbps 21.35% 5.790 Mbps 6.115 Mbps
BBC TWO 4231 6.102 Mbps 21.43% 5.805 Mbps 6.169 Mbps
BBC CHOICE 4351 6.101 Mbps 21.43% 5.804 Mbps 6.166 Mbps
BBC NEWS 24 4415 5.969 Mbps 20.96% 5.679 Mbps 5.996 Mbps
BBC TEXT 4479 0.883 Mbps 3.10% 0.594 Mbps 0.902 Mbps
BBC PARLMNT 4543 0.975 Mbps 3.42% 0.686 Mbps 0.994 Mbps

Figure 2- 40: Bar chart

The following information is included with the bit rate bar charts:

- Error status (LED)
- Object name (Program or PID name)
- Stream type (PIDs only)
- Bit rate bar including change bars and limit markers, where relevant

- Bit rate statistics (including the current bit rate, the bit rate expressed as a percentage of the overall bit rate, and the maximum and minimum values reached during analysis).

The bit rate bars are scaled so that all bars are displayed relative to the one with the highest bit rate.

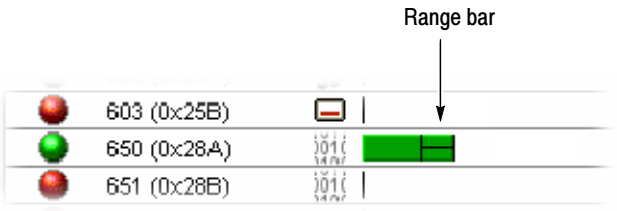
Column widths can be adjusted by dragging the title line dividing bar to the left or right with the mouse.

Error Indication

Two levels of error status are displayed by each row. The error status LED shows the test status of the element, for example, a program. The color of the bit rate bar indicates the bit rate status and whether the rate has exceeded the limits set.

Range Bar

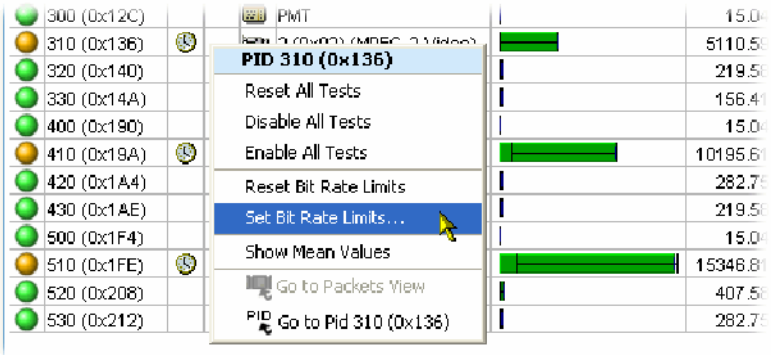
A range bar indicates the variation of bit rate in each program or PID. The ends of the bar show the maximum and minimum values of the bit rate since monitoring started.



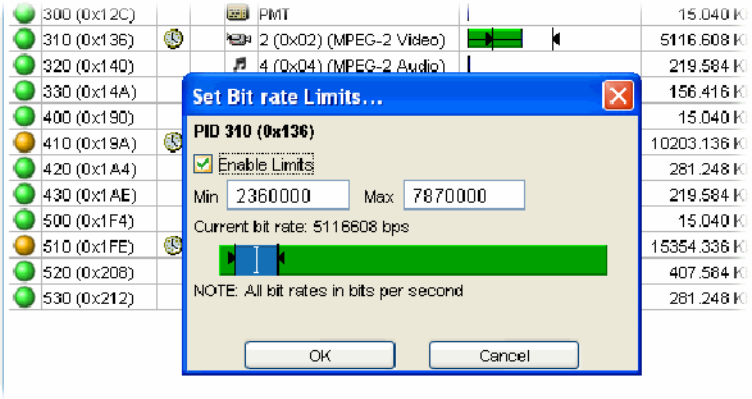
Bit Rate Limits

Bit rate limits can be set on a program or PID bar. An error will be indicated when the bit rate exceeds the limits set.

Highlight the program or PID and select Set bit rate limits from the context menu:



The Set bit rate limits dialog box is opened:



Enable the limits by selecting the Enable Limits checkbox and enter the required values. The cursor in the bar indicates the current bit rate. The limits can also be changed by dragging the limit icons in the dialog box to the required positions. The color of the overall bar in the limits dialog box indicates whether the current bit rate is within the proposed limits. Select OK to close the dialog box. The limit icons will now be displayed on the bit rate bar. The scaling of all bars is recalculated to ensure that the maximum limit is displayed.

During deferred analysis, the stream must be closed and reopened to reanalyze it and view the effects of the limits. Real-time limits take effect immediately. Limit values are retained when the application is closed; limits set for specific PIDs will be applied (to a PID with the same number) irrespective of the stream being analyzed.

Setting (and resetting) the bit rate limits for programs and PIDs will automatically update the Program Occupancy and PID Occupancy tests. To change the transport stream bit rate limits, the parameters must be altered directly in the Transport Stream Occupancy test; this can be found under the Other tab in the Tests view.

The Bit rate Limits of *all* programs in a stream can be disabled and reset by selecting the Clear Limits button at the top of the Programs screen.

Pie Charts

The pie chart shows similar information to the bar chart.

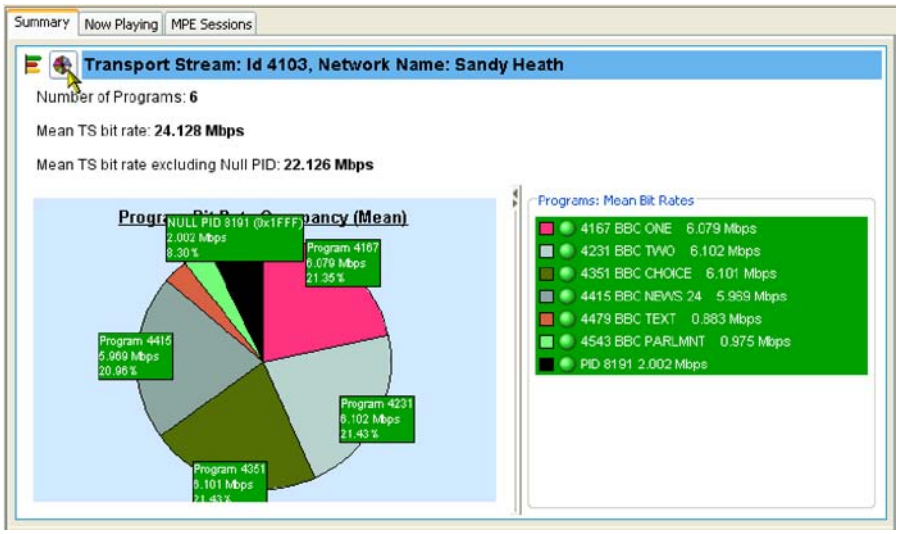


Figure 2-41: Pie chart

The pie chart view is divided into two panes. The left pane shows the pie chart; the right pane provides a list of the component programs. Each program is color-coded; related information given includes the overall program status (icon), the program name and number, and the bit rate (bps). The bit rate expressed as a percentage of the overall bit rate is displayed in the segment labels. The maximum and minimum values are not shown.

If a segment label is hidden at the edge of the window, click on a segment to display the label in full.

EPG View

An electronic program guide (EPG) (where present) is a schedule of events (programs) that are or will be available on each service; a short summary or commentary for each event may also be included. Events for services which are actually carried in the stream are referred to as “actual” and as “present” or “following” (labeled as EIT actual p/f in the navigation view).

A transport stream may also carry EPG information for other network services, referred to as “other” (labeled as EIT other p/f in the navigation view).

***NOTE**. The examples shown in the figures in this section are of DVB transport streams. The construction of SI and node names in ATSC and ISDB streams differ.*

The EPG node in the navigation view contains and displays all of the program information carried in the transport stream.

The content of the Detail view will depend on the EPG currently highlighted table node. Nodes representing an individual table or subtable will offer the usual Summary, Section, and SI Repetition graph detail views. However, the higher nodes will display a graphical representation of the programming information as shown in Figure 2–42.

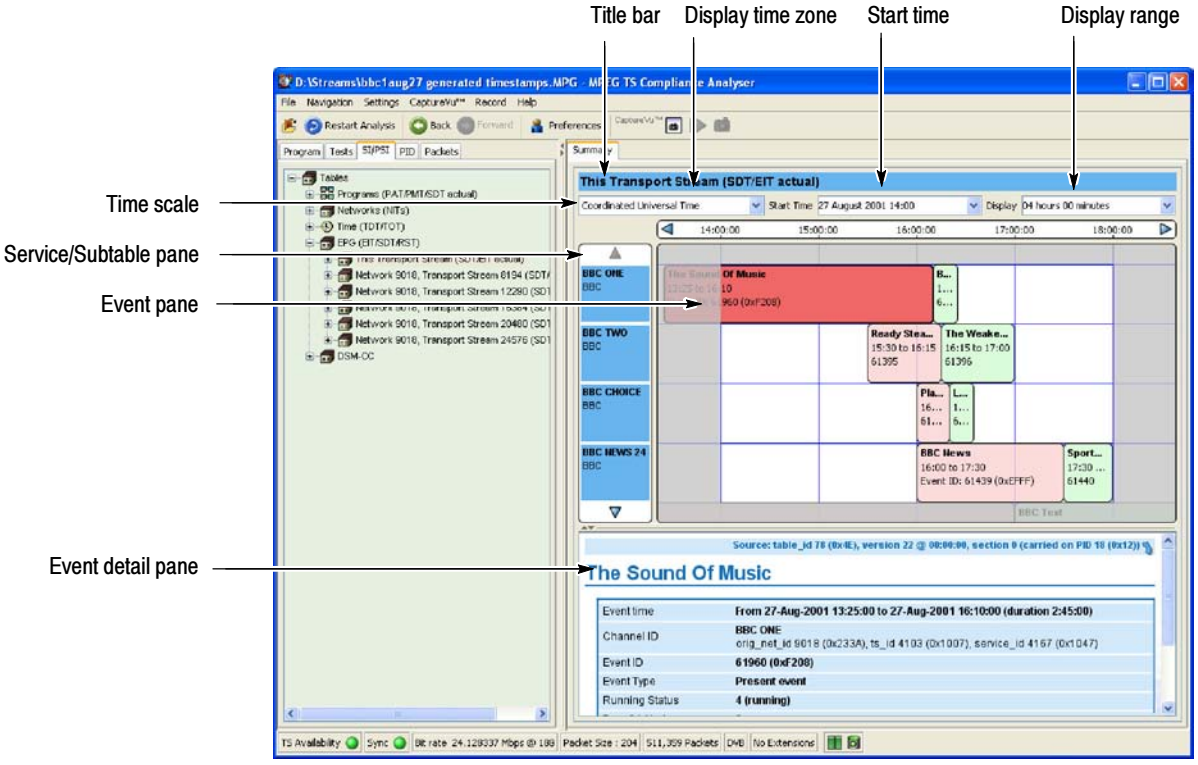


Figure 2- 42: EPG Summary view

EPG Node Summary

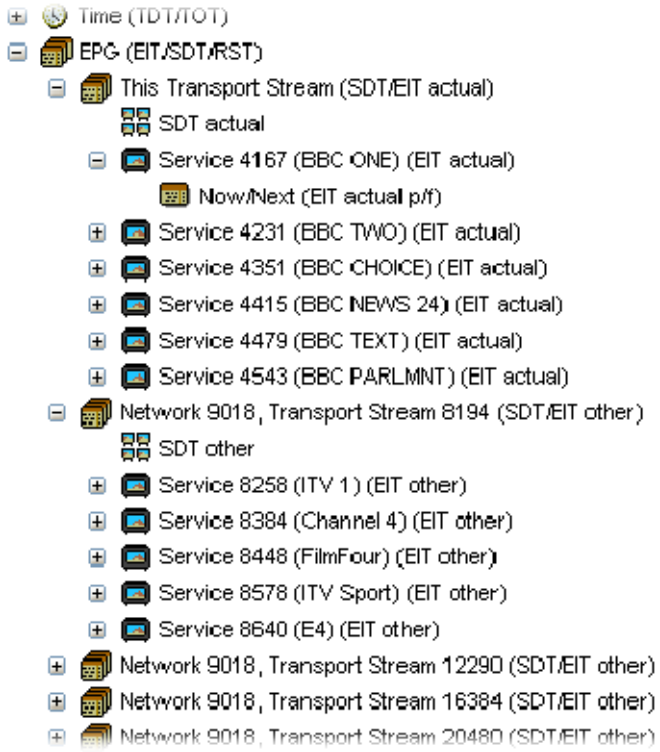

Time (TDT/TOT)
EPG (EIT/SDT/RST)
This Transport Stream (SDT/EIT actual)
SDT actual
Service 4167 (BBC ONE) (EIT actual)
Now/Next (EIT actual p/f)
Service 4231 (BBC TWO) (EIT actual)
Service 4351 (BBC CHOICE) (EIT actual)
Service 4415 (BBC NEWS 24) (EIT actual)
Service 4479 (BBC TEXT) (EIT actual)
Service 4543 (BBC PARLMNT) (EIT actual)
Network 9018, Transport Stream 8194 (SDT/EIT other)
SDT other
Service 8258 (ITV 1) (EIT other)
Service 8384 (Channel 4) (EIT other)
Service 8448 (FilmFour) (EIT other)
Service 8578 (ITV Sport) (EIT other)
Service 8640 (E4) (EIT other)
Network 9018, Transport Stream 12290 (SDT/EIT other)
Network 9018, Transport Stream 16384 (SDT/EIT other)
Network 9018, Transport Stream 20480 (SDT/EIT other)

Figure 2-43: EPG nodes

For each node type, the detail view shows the following information:

EPG node	Links to the EPG information for all the transport streams described in this stream.
Transport stream summary nodes:	Graphical view of the events identified in the service(s) belonging to a specific transport stream.
SDT nodes: (Service Description Table)	Links to services identified in the SI for a specific transport stream.
Service summary nodes:	Graphical view of the events identified in the service.
EIT nodes:	Detailed view of event information for a single EIT subtable.

EPG Summary View

The screen elements highlighted in Figure 2–42 are described below:

Title bar: Displays the title of the currently highlighted service or transport stream.

Displayed Time Zone: Select the required time zone from the drop-down list. The time scale will change accordingly. The time zone may be derived either from the transport stream, UTC (Co-coordinated Universal Time), or local time (as set on the host computer).

Start Time: Shows the event panel start time and date; other dates can be selected from the drop-down calendar; the display will scroll to the selected date.

In deferred mode, the initial date and time will be dictated by the information found in the stream. If the selected date is beyond that held in the EPG information, the date will be automatically set to the last date held in the information.

Note that in real-time mode, this information is updated regularly.

Display: Shows the extent of the event panel; more detail can be displayed by choosing a shorter time period. Select the required range from the drop-down list.

Timescale: Shows the start and end time of the current event panel. The range is dictated by the Display field selection.

Service/Subtable panel: When a transport stream EPG is selected, this panel shows the names of the services currently displayed in the event panel. The displayed services will vary depending on which node is selected in the navigation view.

Event panel: This panel shows the events for one or more services, depending on the selected node. Individual events are color-coded and shown as blocks; each block (and its associated tooltip) displays event information that is extracted from the EIT. When a block is selected, the complete event information is shown in the event detail panel, including a link to the section carrying the information.

Events are color-coded as follows:

- Red: Present event
- Green: Following event
- Blue: Schedule event
- Yellow: (ISDB only) After event

Event detail panel: Shows details of the selected event. The details are contained in the EIT (event information table).

MPE Views

Multi-Protocol Encapsulation (MPE) provides a mechanism for transporting data network protocols on top of the MPEG-2 transport streams in DVB networks; it has been optimized for the carriage of the internet protocol (IP). It covers unicast (datagrams targeted to a single receiver), multicast (datagrams targeted to a group of receivers), and broadcast (datagrams targeted to all receivers). The 48 bit MAC (Media Access Control) addresses are used for addressing receivers.

The MPE views display the MPE data flow currently available in the stream.

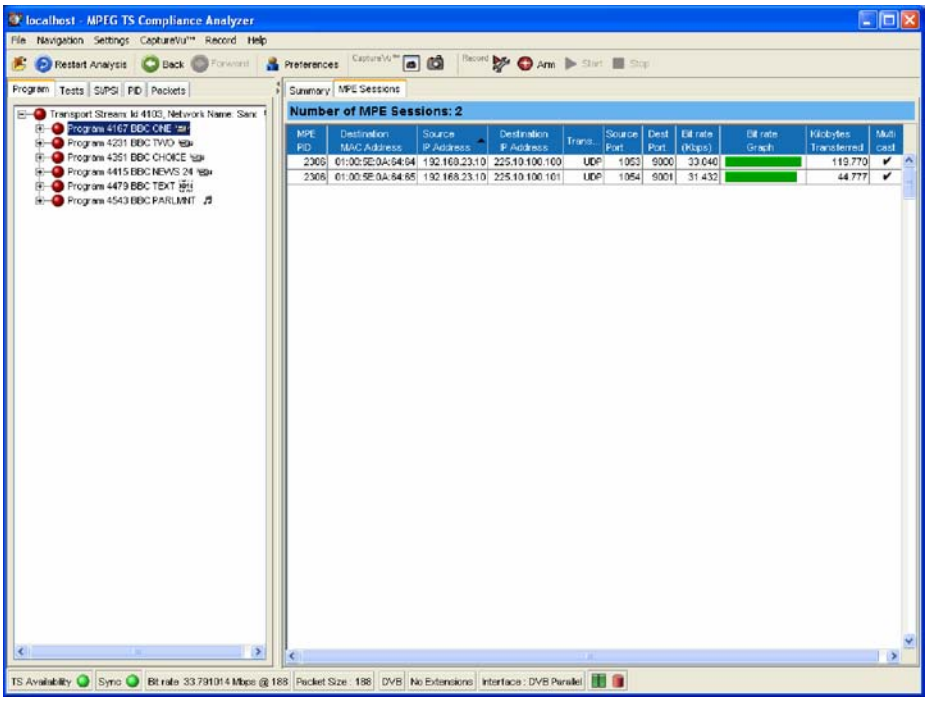


Figure 2- 44: MPE view

CaptureVu™ Feature

The CaptureVu feature allows you to capture and analyze system events during deferred or real-time analysis in order to debug the intermittent and complex problems that traditional analyzers miss.

The feature can be activated either manually by selecting the capture button during analysis or automatically by a CaptureVu breakpoint preset on a test. This action freezes the analysis and allows details of the analysis up to that moment to be examined.

Links to the packet and the test (where applicable) at the point at which the capture button was pressed or a designated test failed are displayed in the CaptureVu Settings dialog box.

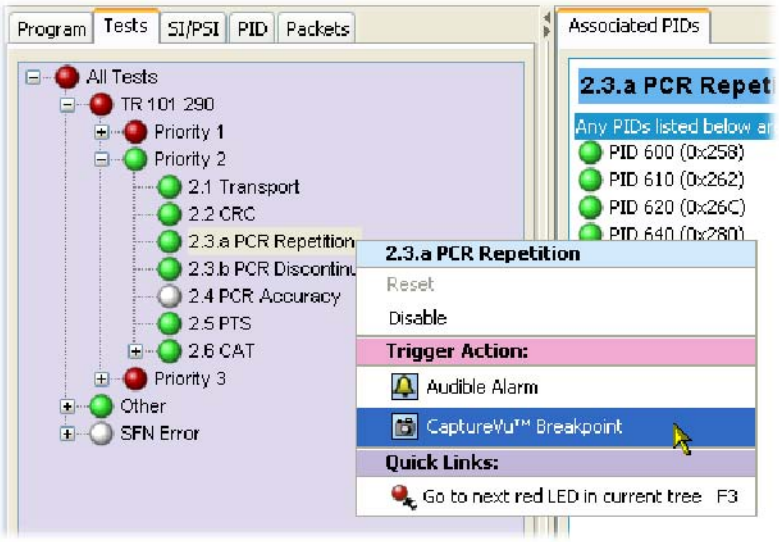
***NOTE**. If a recurring test failure needs to be examined in its true context, it is advisable to make a triggered recording. With pretriggering set, it is then possible to examine the events surrounding a test failure.*
See Triggered Recording, page 2–105.

Setting Up the CaptureVu Feature

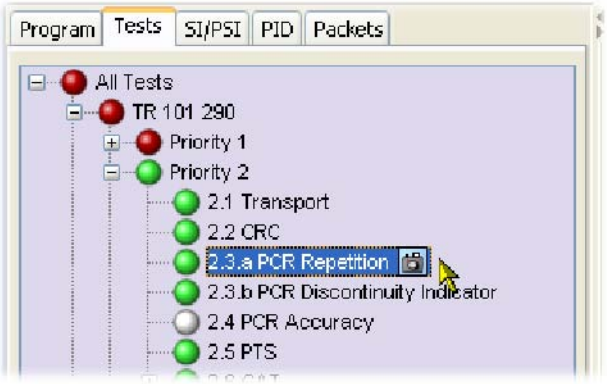
The feature can be activated when a test flagged with a CaptureVu breakpoint does not fall within the parameters set for the test. Breakpoints can be set at any time. They will activate during real-time analysis as soon as the flagged test fails. To operate successfully in a deferred analysis stream, the stream may need to be reanalyzed.

You can set a CaptureVu breakpoint as follows:

1. In either the Program or Tests view, locate and highlight the required test.
2. From the right-click menu, select CaptureVu Breakpoint.



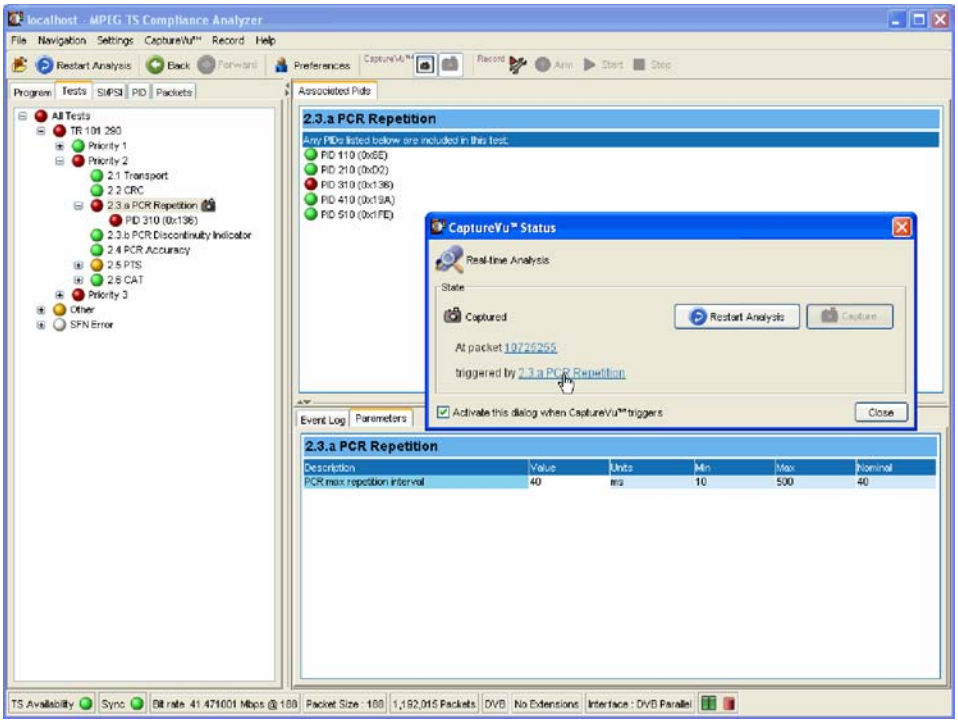
Note the addition of the breakpoint icon beside the test entry.



The CaptureVu breakpoint is now set. You can set as many breakpoints as you require. The next time an error is detected on any breakpoint test, analysis (real-time or deferred) will stop and the test will be identified.

CaptureVu Analysis

The CaptureVu breakpoint will operate during real-time and during deferred analysis. The CaptureVu Settings dialog box is displayed as soon as a breakpoint is activated or the CaptureVu feature is activated from the application Tool Bar.



The dialog box contains the following fields:

State: This panel displays the test and packet in which the test has failed. Clicking either the test or the packet identity will open the related view (Tests or Packets) and highlight the test or packet (see Figure 2-45 and Figure 2-46).

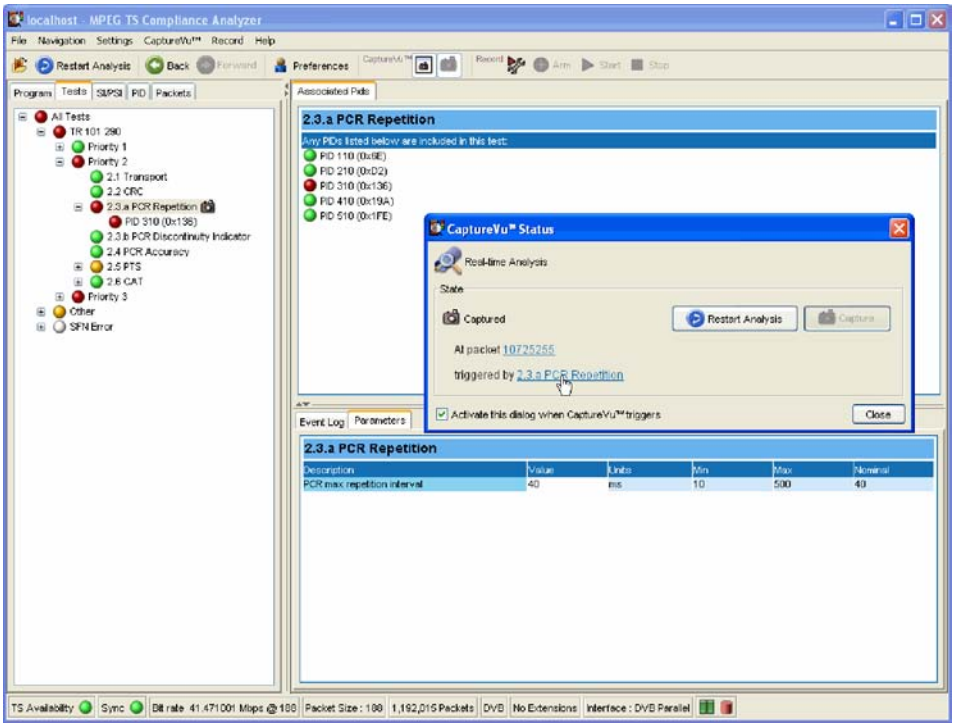


Figure 2- 45: CaptureVu breakpoint - Test view

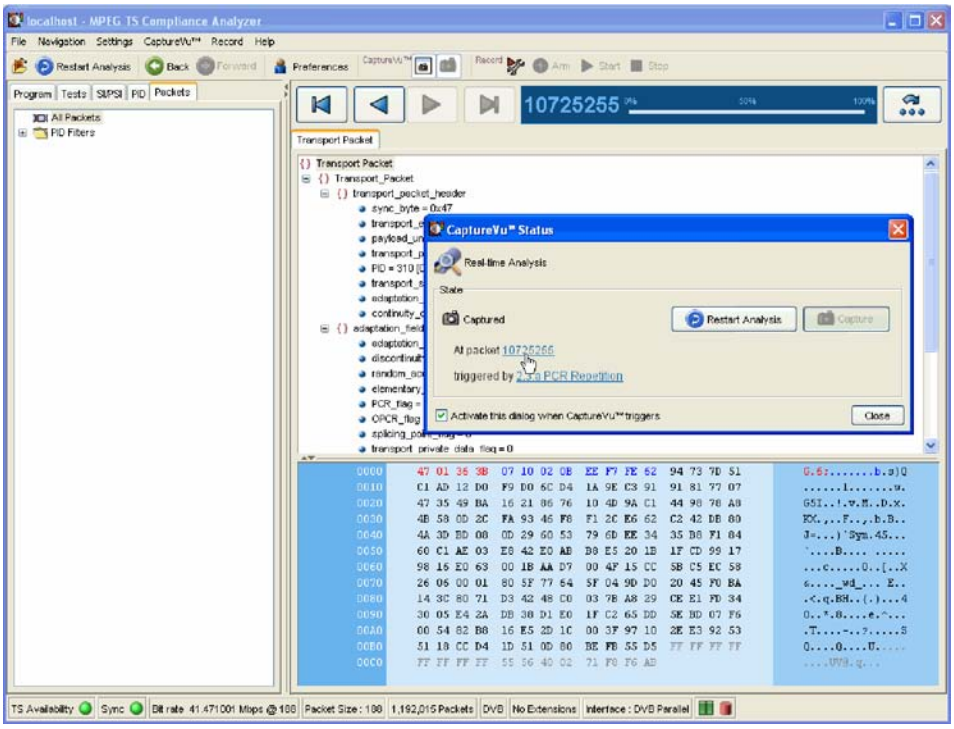


Figure 2- 46: CaptureVu breakpoint - Packet view

Activate this dialog when the breakpoint triggers:
When enabled, the CaptureVu setting dialog box is opened automatically when a breakpoint occurs.

The CaptureVu Settings dialog box can also be viewed at any time by selecting the CaptureVu Settings button on the tool bar.

With the CaptureVu feature activated, all of the TSCA tools are available for you to analyze and inspect the saved information.

***NOTE**. In Packets view, only the packets contained in the last 200 MB are available for analysis.*

Resuming Analysis

You can resume deferred analysis by selecting the Resume Analysis button from the dialog box or the tool bar.

***NOTE**. When you select the Resume Analysis button, analysis will continue from the point at which analysis was paused.*

Similarly, you can resume real-time analysis by selecting the Restart Analysis button from the dialog box or the tool bar.

***NOTE**. While real-time analysis is paused, further analysis is stopped. When the Restart Analysis button is pressed, analysis is restarted at the current time.*

Triggered Recording

During real-time analysis, stream information can only be held for a finite time - eventually it will be overwritten by more up-to-date information.

To examine events that occur in real-time mode more closely, recordings can be made manually or automatically. Recordings are saved to hard disk and can be subsequently analyzed and examined in more detail.

The Triggered Recording setup is accessed by the Record Setting button on the toolbar or Record > Record Settings... on the menu bar; the Recording Settings dialog box is displayed. The dialog fields are described below:

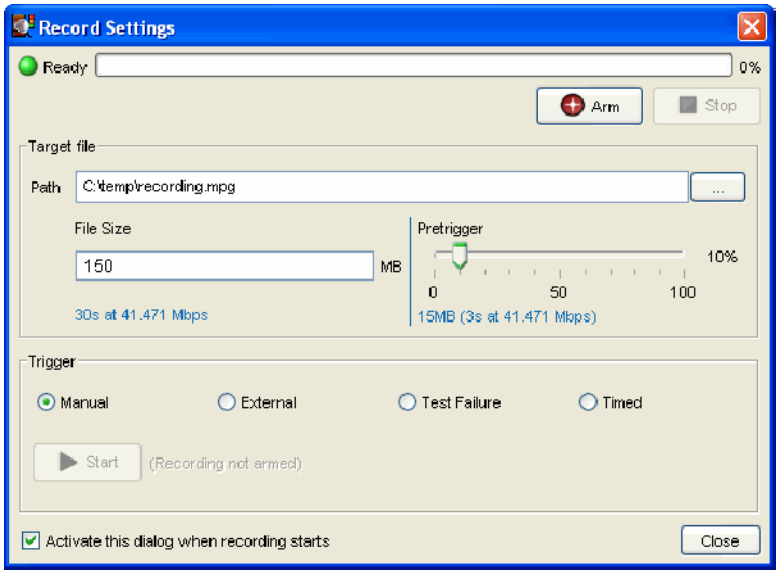


Figure 2- 47: Record Settings dialog box

Status bar: Indicates the trigger status (Ready/Armed/Recording/ Complete) and the pretrigger/recording progress. The status and progress are also displayed on the tool bar in the main window.

Target file

Path: Enter the file name and path for the recording or use the browse button to find and select an existing file name. If this file name already exists, you must approve the over-writing of the old file when recording is initiated.

File Size: Enter the file size (MB) required.
For example, for a stream at 30 Mbps, a file size of 600 MB would record approximately 160 seconds of stream information.

Pre-Trigger: A proportion of a stream can be recorded before a trigger event occurs. (See *Pre-Trigger Recording*, page 2-108.) Enter the pretrigger size (MB) that is to be recorded.

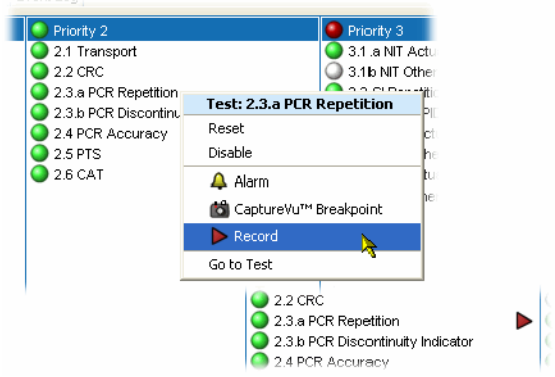
Trigger Type: The event that triggers the recording can be one of five types, selected from the drop-down list. In each case, the trigger is set and pretrigger recording starts when Arm is selected. Pre-trigger recording must be complete before triggered recording will start.

Manual: Recording will start when the Start button is pressed.

External: Recording will start when a rising / falling signal edge is detected at the external trigger input connector. (Refer to the *MTS400 Series Technical Reference*, 071-1724-xx for specifications.)

Test Failure:
Recording will start when an error occurs on a flagged test.

Tests are flagged by highlighting a test in the Program or Tests view and selecting Record from the right-click menu. The record icon is displayed next to the test.



You can set the Record flag on as many tests as you required; recording will be triggered by the first flagged test that is encountered.

Timed: Recording will start when the time and date set in the **Start recording at** field is reached.
You can enter the date and time manually (in the format displayed). The date can be selected from the drop-down calendar.

For all trigger types, except manual, when recording is complete, the starting packet is indicated in the Record Settings dialog box. Click on the packet number to display it in the Packets view.

Buttons

Arm: Places the recording function into an armed state. If a pre-trigger value has been specified, the pre-trigger recording will start (as shown by the progress bar). Full recording will start when any trigger requirements are met.

Stop: Only active during recording, this button either disarms the previously armed trigger or stops recording immediately. Any recording made up to the point when the button is pressed will be lost.

Start: For manual recording, this button becomes active after arming and any pre-trigger conditions have been met; when pressed, recording will start immediately.

The Recording Settings dialog can be left open while waiting for a recording to take place. If, after setting up the recording, the dialog is closed, the recording can be controlled from the tool bar.

Pre-Trigger Recording

Setting a pre-trigger size allows the condition of the final recording to be examined both before and after a trigger event. Pre-triggering a recording allows a section of a recording to be recorded before the trigger event. The pre-triggered portion of the file is filled and written over repeatedly until the trigger event occurs.

Pre-trigger recording starts when the trigger is armed – by pressing Arm.

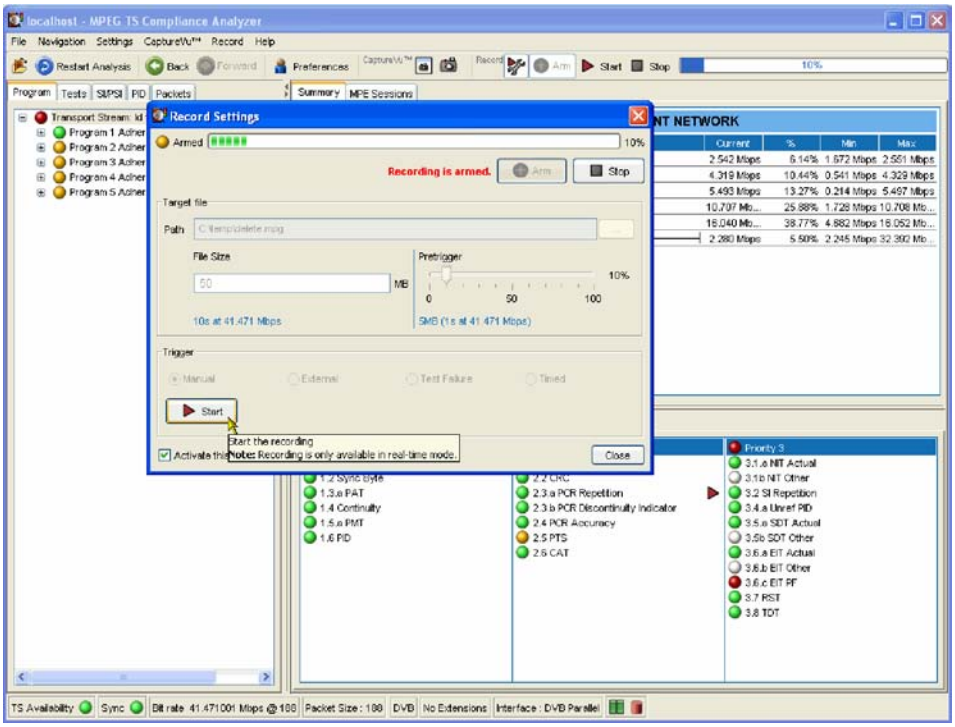


Figure 2- 48: Record Settings dialog box - Armed state

CAUTION. *Recording may fail if the hard disk is unable to match the data rate of the stream. This can be caused by a fragmented hard disk. Regular defragmentation of the hard disk is recommended (refer to your Windows documentation or on-line help).*

Menu Bar and Options

The Menu Bar provides access to a selection of major system options using drop-down menus.

The menus and their options are described in the following paragraphs.

File Menu

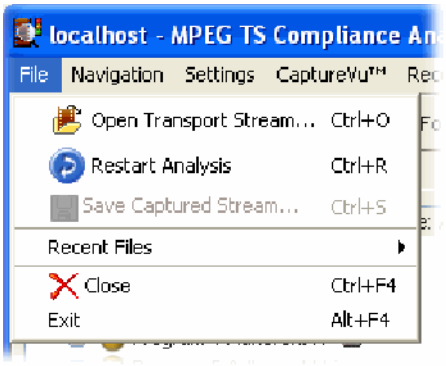


Table 2-8: File menu options

Command	Function
Open Transport Stream…	Opens the Open Transport Stream dialog box from which a stream source (file or real-time) and the interpretation standard can be selected.
Restart Analysis	Stops file analysis (only active during initial analysis).
Save Captured Stream…	Saves the captured stream (200 MB maximum).
Recent Files	Lists the most recently analyzed files. Select a file name to reanalyze the file.
Close	Stop and close the current analysis, leaving the TSCA open.
Exit	Exits the TSCA.

Navigation Menu

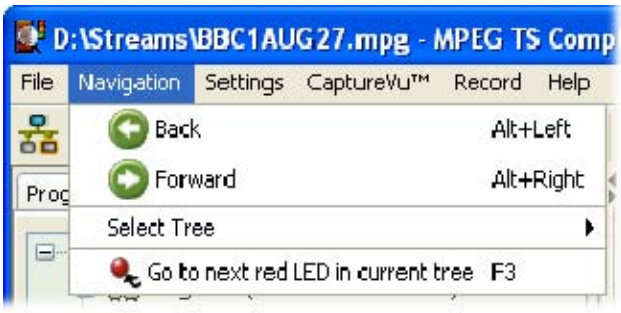


Table 2-9: Navigation menu options

Command	Function
Back	Returns to previous view.
Forward	Goes to next view.
Select Tree	Allows selection of a navigation view (Programs, Tests, SI/PSI, PIDs, Packets).
Go to next red LED in current tree	Goes to and highlights the next errored leaf node. Parent nodes are passed over since they only indicate lower level errors.

Settings Menu

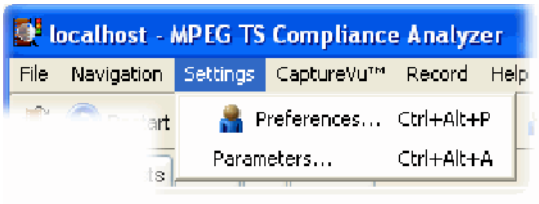


Table 2-10: Settings menu options

Command	Function
Preferences…	Opens the Preferences dialog box which enables interface management (see *Preferences*, page 2-112).
Parameters…	Opens the Parameters dialog box which allows all stream parameters to be viewed and edited.

CaptureVu™ Menu

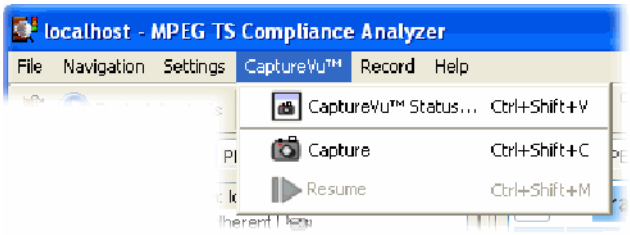


Table 2-11: CaptureVu™ menu options

Command	Function
CaptureVu Status…	Opens the CaptureVu status dialog box.
Capture	Pauses the current analysis to allow detailed inspection.
Resume	Resumes analysis.

Record Menu

The Record menu is only available during real-time analysis.

Table 2-12: Record menu options

Command	Function
Record Settings	Opens the Record Settings dialog box.
Arm	Arms the record function.
Start	Starts recording.
Stop	Stops recording.

Help Menu

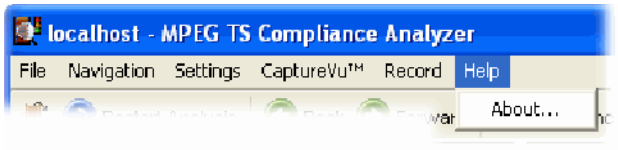


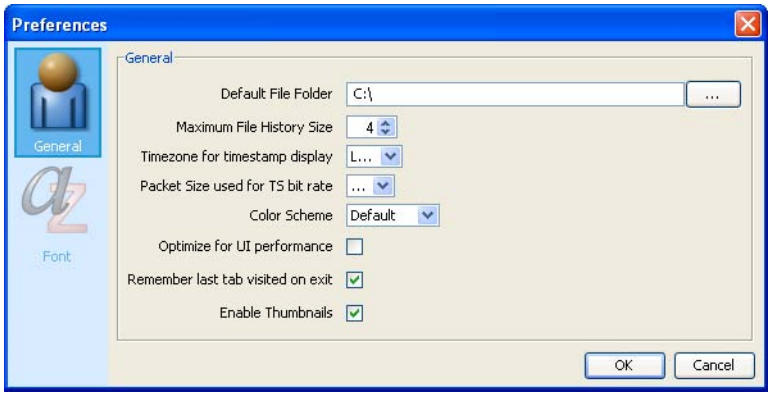
Table 2-13: Help menu options

Command	Function
About…	Displays application and system information.

Preferences

Two options are offered when the Preferences dialog box is opened (Settings > Preferences...) - General and Font.

General



???

Figure 2-49: Preferences - General

The General preferences option allows you to specify a default folder for loading and saving files. Either enter the path required or use the browse button to locate the folder. Select OK to save the setting and close the dialog box.

Default File Folder: Specify the default folder for loading and saving files.

Maximum File History Size:
Specify the maximum number of file names to be shown in the **File > Recent Files** list.

Timezone for timestamp display:
This selection is not currently used. Ensure that it is set to **Local**.

Packet Size used for TS bit rate:
Specify the packet size (188 or 204) to be used in the calculation of the transport stream bit rate. This is displayed in the status bar.

Color Scheme: Select the background color for all graphs. When **Default** is selected, the graphs are based on a white background. When **Instrument** is selected, the graphs are based on a black backgrounds.

Optimize for UI performance:
Under some circumstances when analyzing large files or using low specification instruments, the user interface may appear to freeze until the deferred analysis is complete. Enabling this feature will cause the user interface to refresh at more regular intervals, thus reassuring you that the analysis is progressing.

Remember last tab visited on exit:
When the TSCA is opened, the tab that was being viewed in the previous session will be remembered and displayed.

Enable thumbnails: Thumbnail views of program content will be displayed when this option is enabled.

Font

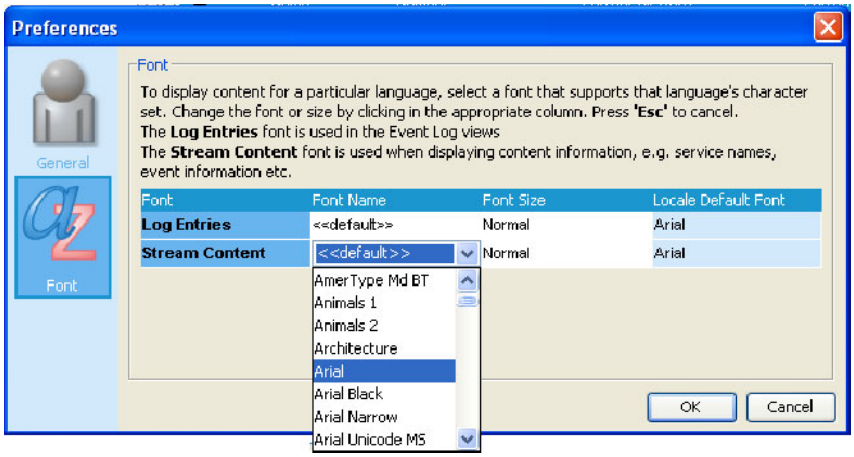


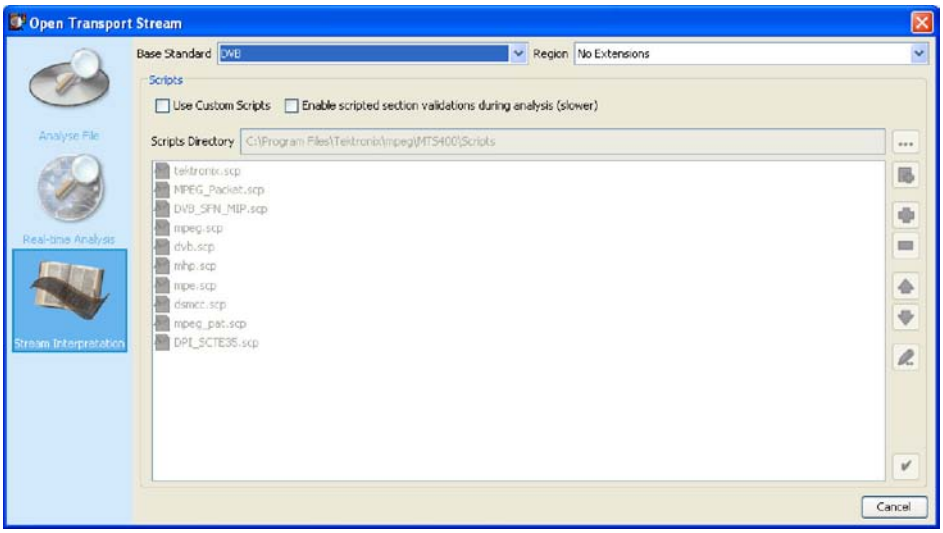
Figure 2-50: Preferences - Font

The Font preferences option allows you to specify the display font and size for log entries and stream content. Place the cursor in the field to be changed and select the font name or font size required from the displayed drop-down list.

Script Files

In the TSCA, scripts provide a method of interpreting and displaying standards during analysis. Scripts provide templates, which determine how the SI information found during stream analysis will be displayed. The scripts must cater for all the information that may be found in a stream, including the various table types found in all of the identified standards. To this end, it has been found that the best approach is to make the scripts modular; each script module deals with different aspects of the SI and standards.

For example, when DVB is identified as the standard against which analysis is to take place, the scripting dialog box displays a list of Script modules. Additionally, when it is known that tables or descriptors not commonly carried in the identified base standard and region are likely to be included, extra scripts can be written and added to the Script Files list to be used for the analysis.



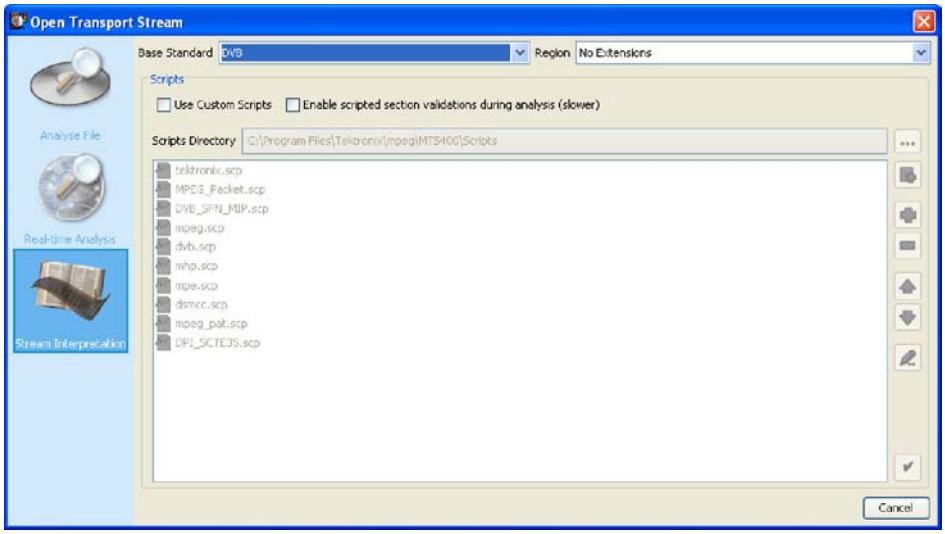
Essential scripts are installed and enabled using the Stream Interpretation dialog. In the absence of any enabled scripts, only the PAT table will be analyzed, all other data will be presented as private data.

Scripts can be customized or new scripts can be written to provide analysis of private data. With the Custom Scripts checkbox enabled, if a suitably configured script is selected and enabled before a stream is analyzed, custom data will also be analyzed when the stream is opened.

Scripts can only be selected and enabled when no files are open. The Stream Interpretation dialog is available when a file is open, but all selection activity is disabled.

A script file will not be used for analysis until it is present in the Script Files panel of the Open Transport Stream dialog box.

Setting Stream Interpretation



1. From the **Base Standard** drop-down list, select the required base standard.

   The selected standard will dictate the availability of options that are available in the Regions drop-down list.

2. From the **Region** drop-down list, select the required region.

   The regions list allows country-specific extensions to be added to the base standard scripts. If **No Extensions** is selected, only the standard scripts are listed in the script list. The remaining country-specific extensions add extra scripts to the current listing.

3. Note that the scripts that will be used are listed in the main pane.

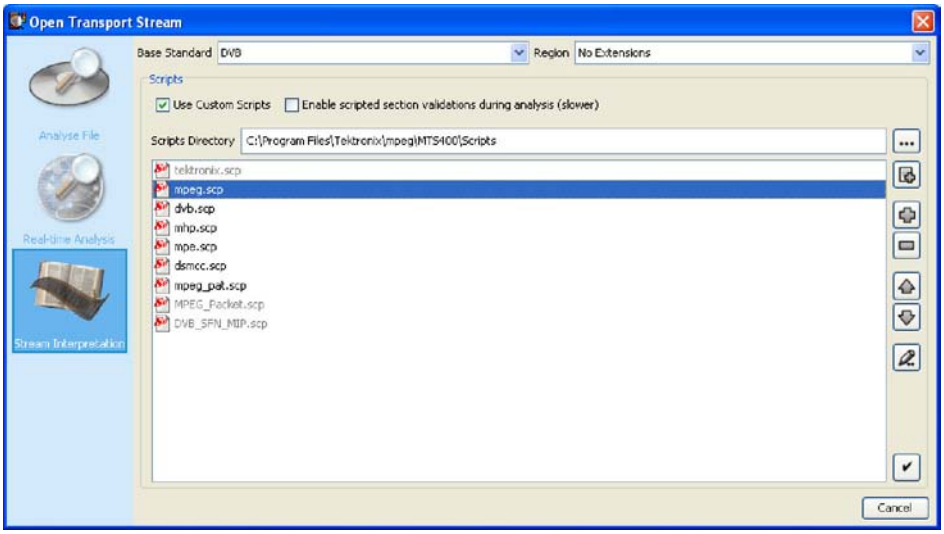
   Scripts listed by default are resident in the default installation directory (program files\tektronix\mpeg\mts400\scripts). Other directory locations can be specified in the custom script selection mode. All selections will be retained between TSCA sessions.

4. Return to either the Analyze File or the Real-time Analysis window, ensure that a stream is selected, and select OK for analysis to start.

Scripts are syntactically analyzed when the OK button is selected. A fault in the syntax of a script will not necessarily prevent a stream from being analyzed, but it may result in an incomplete analysis of the stream. Errors in the script syntax will be noted in the stream log.

Custom Script Selection

When the Custom Scripts checkbox is enabled, the buttons beside the script listing become active and custom scripts can be selected in addition to the standard scripts. Some script names in the listing are dimmed; these are considered to be essential and cannot be removed.



The buttons operate as follows:

Reset the script list to the default list for the standard and region.

Opens the script selection dialog box. Highlight required script and select OK. Note that the script name is added to the Script Files list.

Removes any script name highlighted in the Script Files list.

Scripts are applied to streams in the order that they are listed in the Script Files list. Use these buttons to move a highlighted script up and down in the list.

Opens the highlighted script in ScriptPad script editor

Verifies the syntax of the scripts listed in the Script Files pane. A message window lists any errors found.

If the standard script list has been changed and you want to return to the default list of scripts, highlight the Base Standard and Region required, and select the default script button; the list will be overwritten with the default list.

(More information about ScriptPad can be found in the *MTS400 MPEG Test System User Manual*.)

Scripts Directory

The Scripts Directory field indicates the root directory for scripts named in Script Files list when analysis starts. If scripts are not present in the scripts directory, the interpretation and validation of the SI will be incomplete.

***NOTE**. If the script list is modified in any way, always use the button to verify the changes.*

Scripts can be selected from any directory (using the button). If the directory is not that identified in the Scripts Directory field, the path (either relative or absolute) will be displayed with the script name in the Script Files list.

***NOTE**. The Scripts Directory browse button allows you to specify a default directory for script selection. The browse window does not display the scripts available. If you need to see the scripts available, use Windows Explorer.*

If the standard script list has been customized and you want to return to the default list of scripts, highlight the required Base Standard and Region and select the default script button; the list will be overwritten with the default list.

***NOTE**. Each Base Standard and Region combination can be individually customized.*

Script Validation

Validating scripts checks the syntax of the listed scripts.

If the **Enabled scripted section validations during analysis** checkbox is enabled, the scripts are checked during analysis to ensure that the data as defined by the scripts is as expected (for example, values are within specified ranges). A fault in the syntax of a script will not necessarily prevent a stream from being analyzed, but it may result in incomplete analysis of the stream. Errors in script validation will be logged in the stream error log. Enabling this checkbox may have an impact on real-time analysis.

Task Examples

The examples in this section describe how to locate a fault or information using the analyzer.

The examples assume a basic understanding of the analyzer user interface and that you are familiar with the more important aspects of digital television transport stream structure and interpretation standards.

The MPEG Test System is a tool which allows you to analyze a transport stream and then examine it in detail. Errors in the content can be pinpointed and examined down to the byte level.

Because of the comprehensive nature of the analyzer, there are a number of ways of achieving your objective. In these examples, one or more ways are described to achieve the objective.

Error Status

LED icons are used throughout the analyzer interface to represent the status of the tests applied to associated items, for example, programs. Colors used are as follows:

	(Red)	Error; test failed
	(Yellow)	Transient error (error not currently being detected but has been seen since last reset)
	(Green)	No error; test passed
	(Gray)	Test disabled
	(White)	Test not applicable

When an LED represents a parent node in a tree (for example, a program node is the parent of elementary stream nodes) or a navigation tab, the color represents the worst case of all of its tests and the worst case of all of the tests represented by its child nodes.

Similarly, when an LED representing a parent node in a tree is disabled or enabled, all subsidiary (or child) nodes are also disabled or enabled to reflect the state of the parent node. When an LED representing a parent node is reset, all the child nodes are also reset.

Which Tests Have Failed in an Analyzed Stream?

In this example, the analyzer has just finished analyzing a stream. The Program navigation view is initially displayed with the transport stream tree collapsed. The transport stream error LED is red, indicating that one or more tests have failed.

Method With the Program tab still selected, view the tests summary view (bottom right).

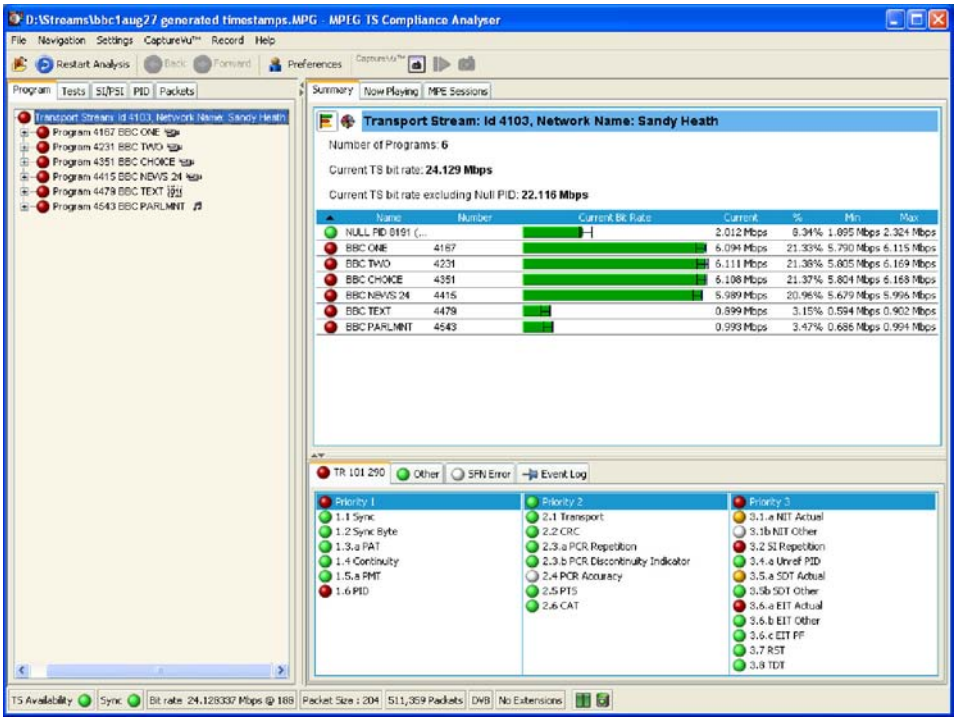

D:\Streams\bbc1aug27 generated timestamps.MPG - MPEG TS Compliance Analyser
File Navigation Settings CaptureVu™ Record Help
Restart Analysis Back Forward Preferences
Program Tests SI/PSI PID Packets
Transport Stream: Id 4103, Network Name: Sandy Heath
Program 4167 BBC ONE
Program 4231 BBC TWO
Program 4351 BBC CHOICE
Program 4415 BBC NEWS 24
Program 4479 BBC TEXT
Program 4543 BBC PARLMNT
Summary Now Playing MPE Sessions
Transport Stream: Id 4103, Network Name: Sandy Heath
Number of Programs: 6
Current TS bit rate: 24.129 Mbps
Current TS bit rate excluding Null PID: 22.116 Mbps
Name Number Current BR Rate Current % Min Max
NULL PID 8191 (... 2.012 Mbps 8.34% 1.695 Mbps 2.324 Mbps
BBC ONE 4167 6.094 Mbps 21.33% 5.790 Mbps 6.115 Mbps
BBC TWO 4231 6.111 Mbps 21.38% 5.805 Mbps 6.169 Mbps
BBC CHOICE 4351 6.108 Mbps 21.37% 5.804 Mbps 6.168 Mbps
BBC NEWS 24 4415 5.989 Mbps 20.96% 5.679 Mbps 5.996 Mbps
BBC TEXT 4479 0.899 Mbps 3.15% 0.594 Mbps 0.902 Mbps
BBC PARLMNT 4543 0.993 Mbps 3.47% 0.686 Mbps 0.994 Mbps
TR 101 290 Other SPN Error Event Log
Priority 1
1.1 Sync
1.2 Sync Byte
1.3.a PAT
1.4 Continuity
1.5.a PMT
1.6 PID
Priority 2
2.1 Transport
2.2 CRC
2.3.a PCR Repetition
2.3.b PCR Discontinuity Indicator
2.4 PCR Accuracy
2.5 PTS
2.6 CAT
Priority 3
3.1.a NIT Actual
3.1b NIT Other
3.2 SI Repetition
3.4.a Unref PID
3.5.a SDT Actual
3.5b SDT Other
3.6.a EIT Actual
3.6.b EIT Other
3.6.c EIT PF
3.7 RST
3.8 TDT
TS Availability Sync Bit rate: 24.128337 Mbps @ 188 Packet Size : 204 511,359 Packets DVB No Extensions

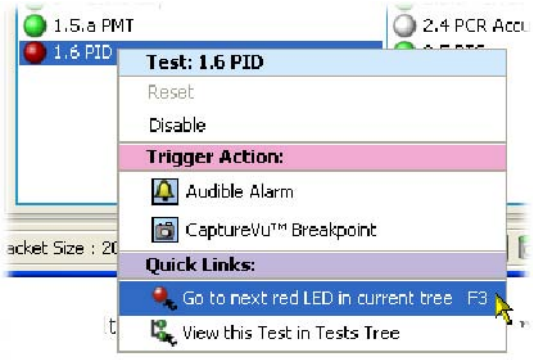
Figure 2-51: Failed tests - example

Identify the tests that have failed (red LED). As shown in Figure 2-51, in test summary view (TR 101 290 tab), the following tests have failed:

- First Priority: 1.6 PID
- Second Priority: 2.3a PCR Repetition
- Third Priority: 3.1a NIT Actual; 3.2 SI Repetition; 3.5a SDT Actual; 3.5b SDT Other

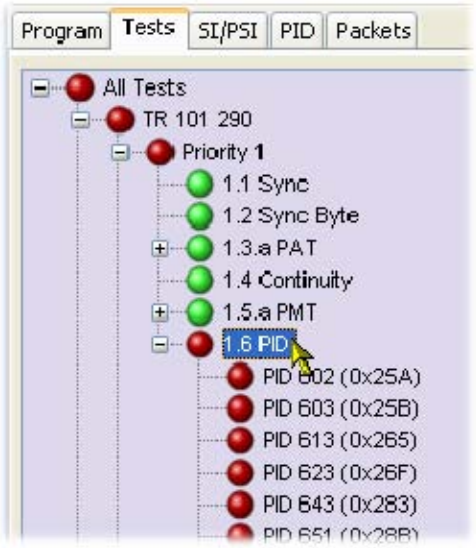
Remember that the tests may be distributed over more than one tab in the test summary view; the color of the LED on the tab helps you locate the failed tests (for example, the Other tab in Figure 2-51).

You can view a test (and see other PIDs that it has failed on) by highlighting a test and selecting Go to test from the context (right click) menu:



You can also display the fault by expanding the tree in the Tests navigation view until the fault is revealed.

Expanding the test itself reveals the PIDs that have failed the test.

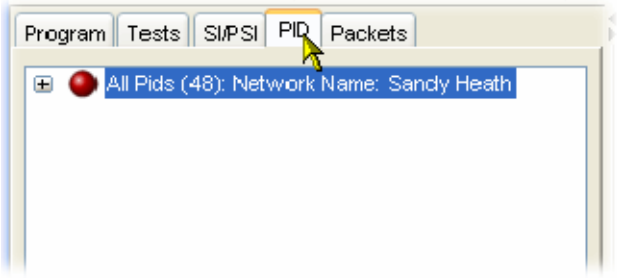


How Many PIDs are in a Stream?
How many PIDs are Referenced and Unreferenced?

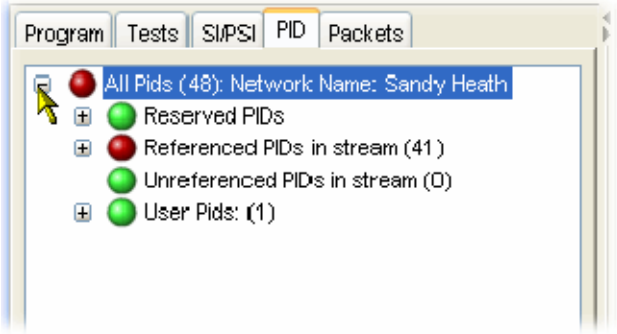
For this task, the PID navigation view is used to view information about individual PIDs in the transport stream. Under the All PIDs node, which displays all of the PIDs in the summary view, there are four subgroup nodes: Reserved PIDs, Referenced PIDs, Unreferenced PIDs and User PIDs. The number (in parenthesis) in each node gives the number of PIDs found during analysis.

Method

1. Select the PIDs navigation view.

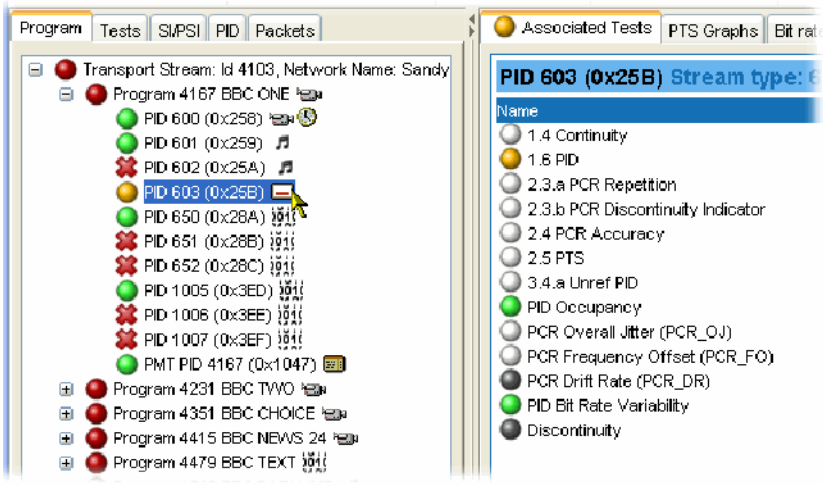


2. Expand the All PIDs node to display the subgroups (and their quantities).



Which Tests Have Been Applied to a Program PID?

1. Select the Program navigation view.



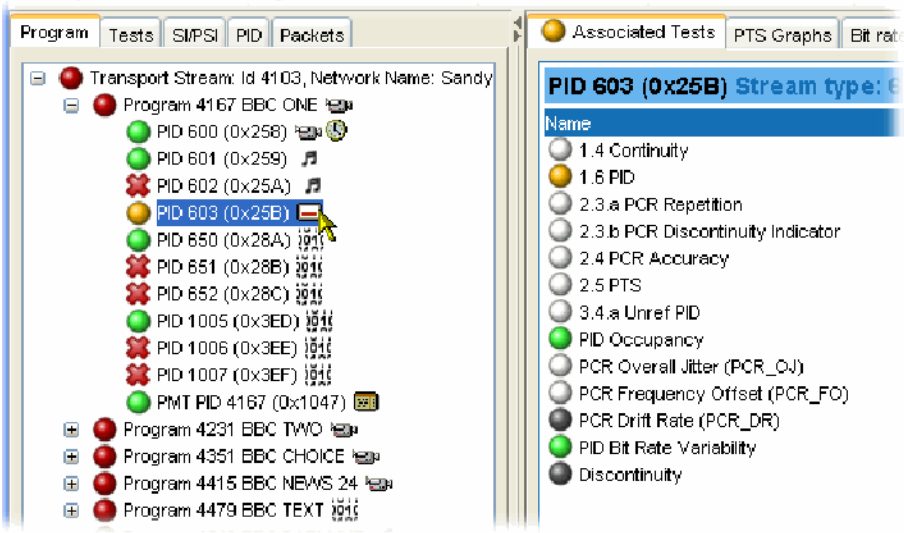
2. Expand the Transport Stream tree until the required PID can be highlighted.

In the Associated Tests view, note the tests that are enabled. Gray LEDs indicate tests that have been disabled; white LEDs indicate tests that are not applicable to the selected PID.

What is the Stream Type of a PID?

Method 1

1. Select the Program navigation view.

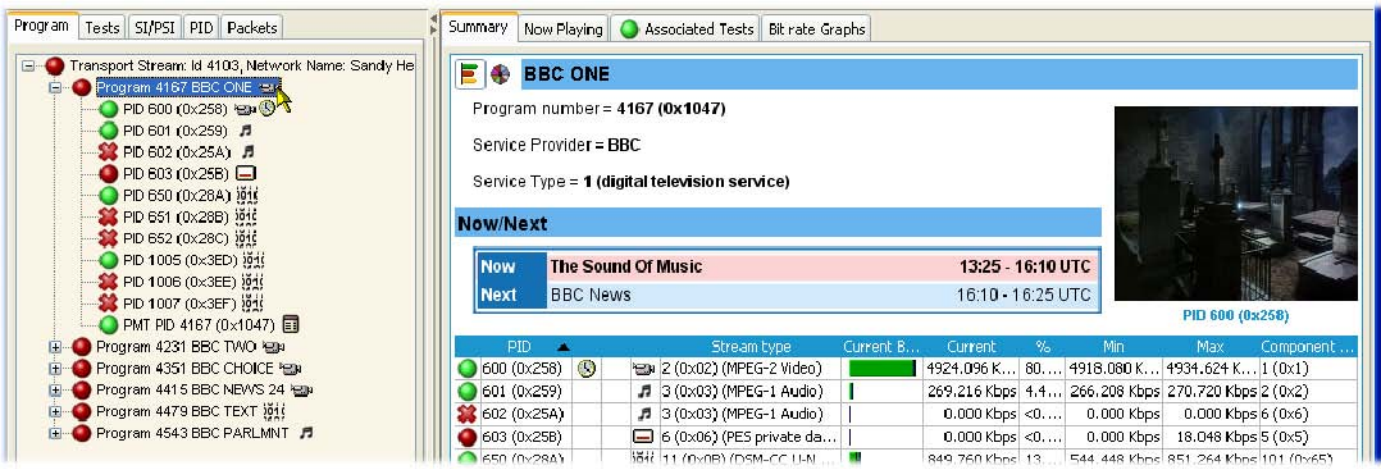


2. Expand the Transport Stream tree until the required PID can be highlighted.
3. Keep the cursor over the PID. A tooltip will display the stream type.

The tooltip is available wherever the selected PID node is displayed (for example, in the PID navigation view).

Method 2

1. Select the Program navigation view.
2. Select the program node.
3. In the summary view, select the Summary tab.



Note the Stream Type column in the display. The stream type is given for each PID in the selected program.

How Many Programs are in the Stream?

1. Select the Program navigation view.
2. Expand the Transport Stream tree and note the number of program nodes (see Figure 2–52).
3. The Summary view (bar chart or pie chart) also displays a program count.

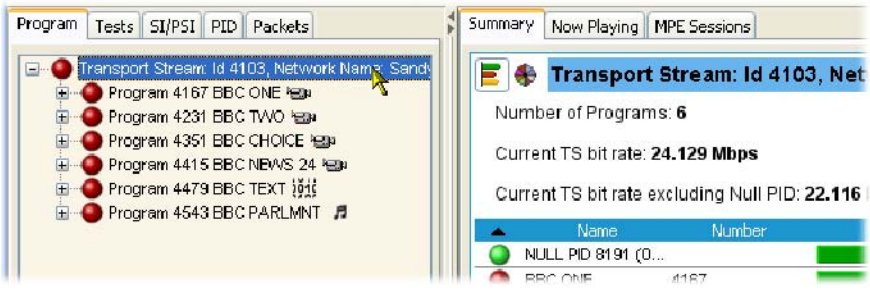


Figure 2-52: Program count

What are the Contents of the Programs and What PIDs are They On?

1. Select the Program navigation view.
2. Expand the Transport Stream tree and a program node (see Figure 2–53).
3. Note the number of program PIDs.
   Note also that each PID is accompanied by an icon indicating the stream type. Hover the cursor over a PID node to display more information.
4. The Summary and the PID Information views also display the program PIDs.

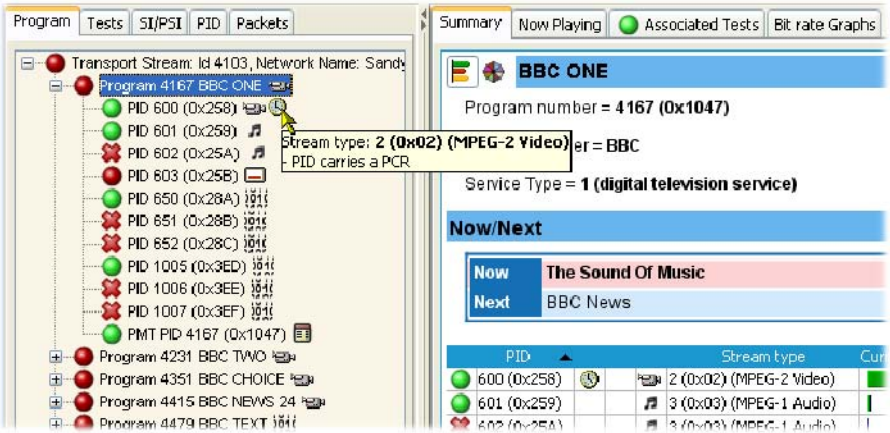


Figure 2- 53: PID count

What is the Bit Rate of each PID in a Program?

Bit rates are displayed in the Program and PID summary views. The bit rates displayed depend on the node highlighted in the navigation view.

Table 2- 14: Bit rate views

Navigation View	Node	Bit rates displayed in Summary view
Program	Transport Stream	All programs
Program	Program	Program PIDs
PID	All PIDs	All PIDs
PID	Secondary nodes (Reserved, Referenced, Unreferenced and User)	PIDs in secondary groups PIDs

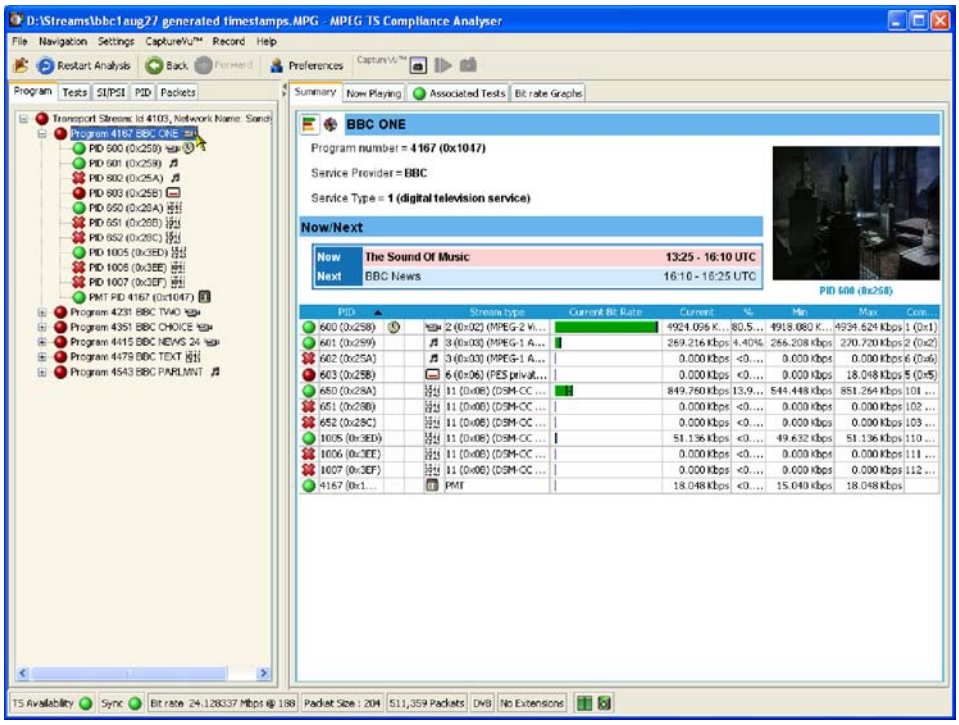

D:\Streams\bbc1aug27 generated timestamps.MPG - MPEG TS Compliance Analyser
File Navigation Settings CaptureVu™ Record Help
Restart Analysis Back Forward Preferences
Program Tests SI/PSI PID Packets
Summary Now Playing Associated Tests Bit rate Graphs
BBC ONE
Program number = 4167 (0x1047)
Service Provider = BBC
Service Type = 1 (digital television service)
Now/Next
Now The Sound Of Music 13:25 - 16:10 UTC
Next BBC News 16:10 - 16:25 UTC
PID 600 (0x258)
PID Stream type Current Bit Rate Current % Min Max
600 (0x258) 2 (0x02) (MPEG-2 Vi... 4924.096 K... 80.5... 4918.080 K... 4934.624 Kbps 1 (0x1)
601 (0x259) 3 (0x03) (MPEG-1 A... 269.216 Kbps 4.40% 266.208 Kbps 270.720 Kbps 2 (0x2)
602 (0x25A) 3 (0x03) (MPEG-1 A... 0.000 Kbps <0.... 0.000 Kbps 0.000 Kbps 6 (0x6)
603 (0x25B) 6 (0x06) (PES privat... 0.000 Kbps <0.... 0.000 Kbps 18.048 Kbps 5 (0x5)
650 (0x28A) 11 (0x0B) (DSM-CC ... 849.760 Kbps 13.9... 544.448 Kbps 851.264 Kbps 101 ...
651 (0x28B) 11 (0x0B) (DSM-CC ... 0.000 Kbps <0.... 0.000 Kbps 0.000 Kbps 102 ...
652 (0x28C) 11 (0x0B) (DSM-CC ... 0.000 Kbps <0.... 0.000 Kbps 0.000 Kbps 103 ...
1005 (0x3ED) 11 (0x0B) (DSM-CC ... 51.136 Kbps <0.... 49.632 Kbps 51.136 Kbps 110 ...
1006 (0x3EE) 11 (0x0B) (DSM-CC ... 0.000 Kbps <0.... 0.000 Kbps 0.000 Kbps 111 ...
1007 (0x3EF) 11 (0x0B) (DSM-CC ... 0.000 Kbps <0.... 0.000 Kbps 0.000 Kbps 112 ...
4167 (0x1... PMT 18.048 Kbps <0.... 15.040 Kbps 18.048 Kbps
TS Availability Sync Bit rate 24.128337 Mbps @ 188 Packet Size : 204 511,359 Packets DVB No Extensions

Figure 2- 54: Program PID bit rate - bar chart

The PID bit rate summaries can be displayed as either bar charts or pie charts by selecting the appropriate icon at the top left of the Summary view.

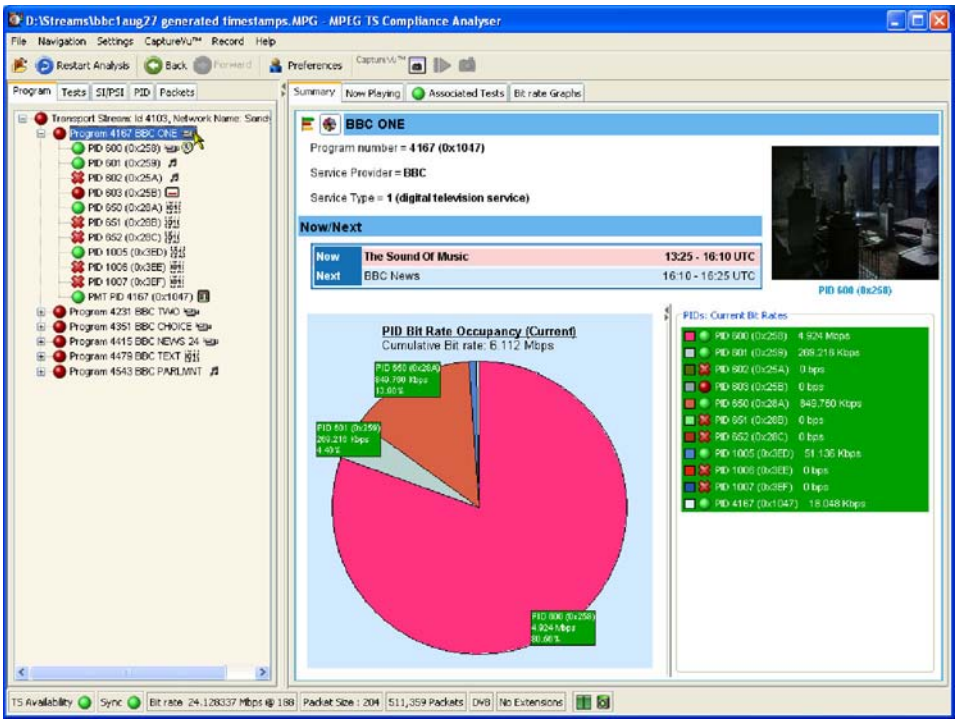

D:\Streams\bbc1aug27 generated timestamps.MPG - MPEG TS Compliance Analyser
File Navigation Settings CaptureVu™ Record Help
Restart Analysis Back Preferences
Program Tests SI/PSI PID Packets
Summary Now Playing Associated Tests Bit rate Graphs
BBC ONE
Program number = 4167 (0x1047)
Service Provider = BBC
Service Type = 1 (digital television service)
Now/Next
Now The Sound Of Music 13:25 - 16:10 UTC
Next BBC News 16:10 - 16:25 UTC
PID Bit Rate Occupancy (Current)
Cumulative Bit rate: 6.112 Mbps
PIDs: Current Bit Rates

Figure 2- 55: Program PID bit rate - pie chart

A selection of statistics for each program/PID is shown in the charts. Either current or mean bit rates can be shown by selecting the Show Mean Values option from the Summary view context menu. For deferred analysis, the current bit rate is the final bit rate.

You can also display a bit rate graph for the highlighted node by selecting the Bit Rate Graphs tab.

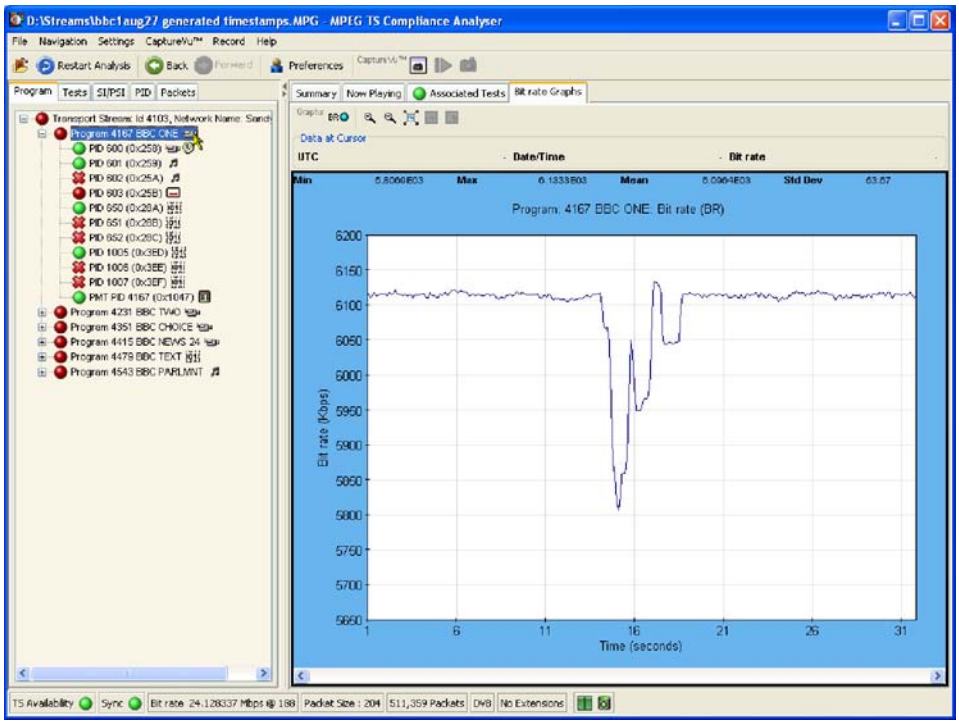


Figure 2- 56: Bit rate graph

What is the Latest Version Number of the Program Association Table (PAT) in the SI?

Tables and their versions can be found in the Tables (SI/PSI) view. When a node representing a table is selected in the navigation view, the table identity and the version are displayed in summary view (top right) as shown in Figure 2-57.

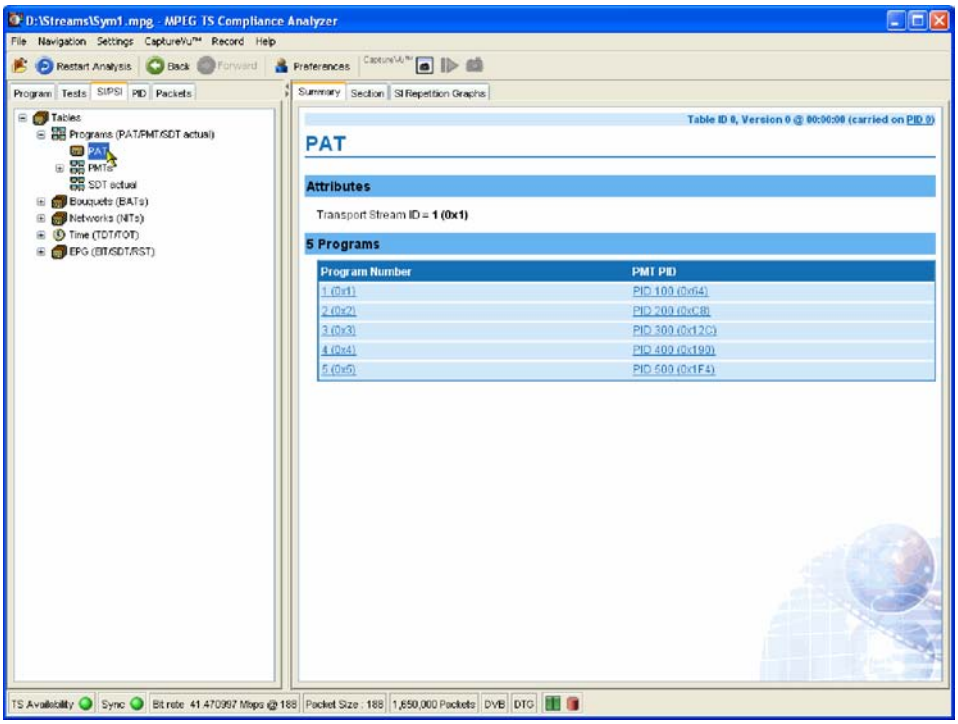


Figure 2-57: Table Identity and Version (summary view)

The table identity and version can also be seen in the table header using the Tables (SI/PSI) section view as shown in Figure 2-58.

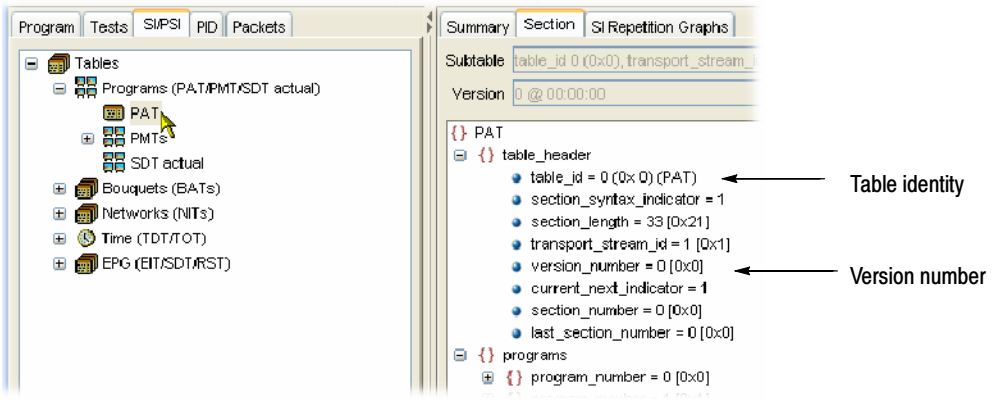


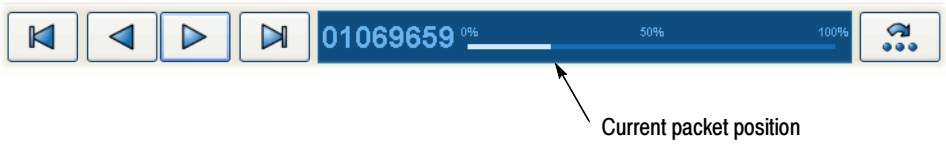
Figure 2- 58: Table Identity and Version (section view)

How Do I Examine a Transport Packet?

A transport stream packet is a unit of data that contains a header and a payload. The Packets view allows individual transport stream packets to be identified and examined.

Navigating Around the Packets

The navigation bar at the top of the Packet summary view is used to move between packets. How the controls work depends on the selection in the Packets navigation view. If All Packets is highlighted, the controls will operate on all packets. If a PID has been identified, added to the PIDs node and highlighted, the controls will operate only on packets carrying the selected PID.



The packet position bar shows the position of the selected packet in the stream.

The controls work as follows:

	Selects the first available packet (in the stream or carrying the selected PID).
	Selects the previous available packet (in the stream or carrying the selected PID).
	Selects the next available packet (in the stream or carrying the selected PID).

	Selects the last available packet (in the stream or carrying the selected PID).
	Open Go to packet... dialog box.

The packet position bar can also be used to navigate through the stream. Use the cursor to point to and click the next packet to be displayed. Similarly, double click the packet number in the bar and enter the required packet number in the Go to packet... dialog box.

Looking at the Packet

Having identified and selected a packet, the Packets summary view displays the interpreted code and the raw data in hexadecimal and ASCII format.

SI/PSI Nodes

The Tables view (SI/PSI tab) displays the service information in tree form. The tree represents all of the service information tables found in the analyzed stream that comply with the selected digital video standard (including MPEG program specific information, DVB service information and ATSC and ISDB program and system information protocol). The tree contains nodes for each table found; tables/nodes are grouped together functionally.

This appendix identifies the nodes that may be present for each standard.

Figure 2-59 shows an example of Table navigation view with DVB stream interpretation selected.

Tables 2-15 to 2-19 show the nodes that may be displayed in the SI/PSI navigation view depending on the interpretation standard selected and the content of the stream.

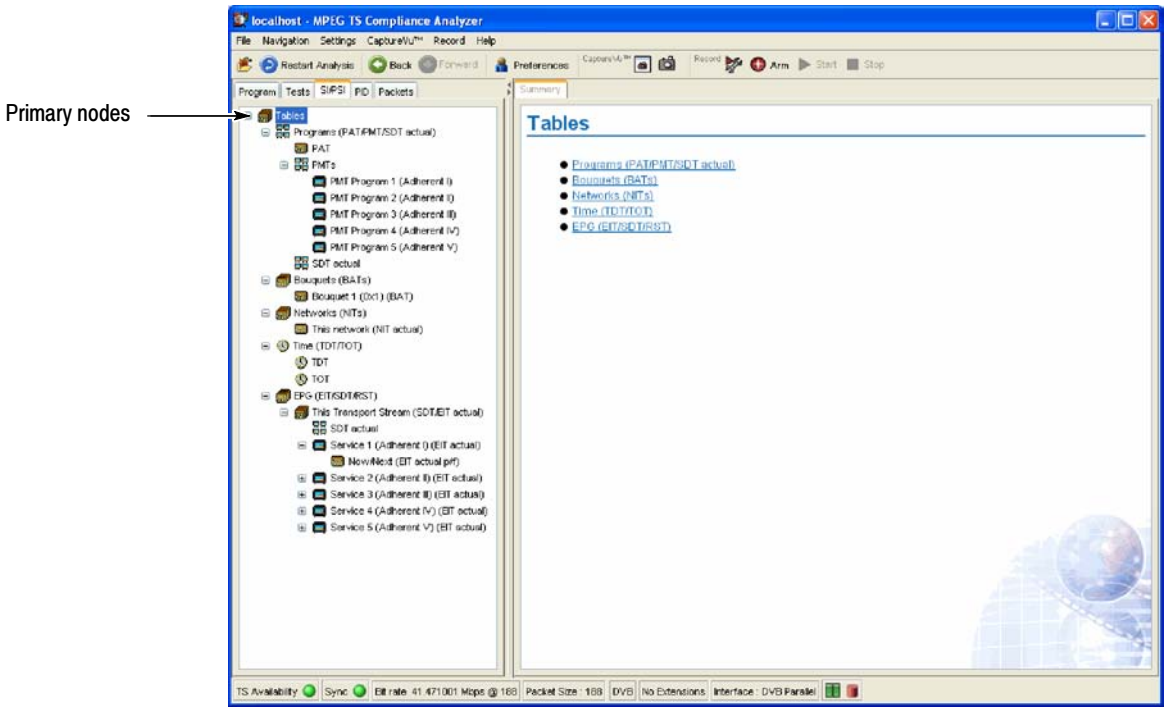


Figure 2-59: Primary SI/PSI nodes (DVB example)

Table 2-15: MPEG SI/PSI

Primary node	Subsidiary node
TS info	
	TSDT
Programs	
	PAT
	PMT PIDs
Conditional access	
	CAT
Other Tables	

Table 2-16: DVB SI/PSI

Primary node	Subsidiary node 1	Subsidiary node 2	Subsidiary node 3
TS Info			
	Partial TS		
		DIT	
		SIT	
	BIT		
Programs			
	PAT		
	PMT PIDs		
		PMT PID +	
	SDT		
Bouquets			
	BAT		
Conditional access			
	CAT		
Networks			
	NIT - This		
	NIT - Other		
Time			
	TOT		

Table 2-16: DVB SI/PSI (Cont.)

Primary node	Subsidiary node 1	Subsidiary node 2	Subsidiary node 3
	TDT		
EPG			
	This TS		
		SDT Actual	
		Service (number, name)	
			Now/Next (EIT P/F)
			Schedule (EIT schedule)
	Other TS		
		SDT Other	
		Service (number, name)	
			Now/Next (EIT P/F)
	RST		
MHP apps			
Other tables			

Table 2-17: ATSC SI/PSI

Primary node	Subsidiary node 1	Subsidiary node 2	Subsidiary node 3	Subsidiary node 4
TS info				
	MGT			
Programs				
	PAT			
	PMT PIDs			
	VCT C/T			
	ETT-V			
Conditional Access				
	CAT			
Ratings				
	RRT+			
Time				

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Table 2-17: ATSC SI/PSI (Cont.)

Primary node	Subsidiary node 1	Subsidiary node 2	Subsidiary node 3	Subsidiary node 4
	STT			
EPG				
	Source/Services			
		EIT0 > EIT127		
Directed channel change				
	DCCT id +			
	DCCSCT			
Other tables				

Table 2-18: ISDB-S SI/PSI nodes

Primary node	Subsidiary node 1	Subsidiary node 2	Subsidiary node 3	Subsidiary node 4
TS info				
	Partial TS			
		DIT		
		SIT		
	BIT			
Programs				
	PAT			
	PMT PIDs			
	SDT			
Conditional access				
	CAT			
Networks				
	NIT - This			
	NIT - Other			
Time				
	TOT			
EPG				
	This TS			
		SDT Actual		
		Service (number, name)		

Table 2-18: ISDB-S SI/PSI nodes (Cont.)

Primary node	Subsidiary node 1	Subsidiary node 2	Subsidiary node 3	Subsidiary node 4
			Now/Next (EIT P/F)	
			Basic Schedule (EIT schedule)	
			Extended Schedule (EIT schedule)	
	Other TS			
		SDT Other		
		Service (number, name)		
			Now/Next (EIT P/F)	
			Basic Schedule (EIT schedule)	
			Extended Schedule (EIT schedule)	
	Maker id/model id +			
Other tables				

Table 2-19: ISDB-T SI/PSI nodes

Primary node	Subsidiary node 1	Subsidiary node 2	Subsidiary node 3	Subsidiary node 4
TS info				
	Partial TS			
		DIT		
		SIT		
	BIT			
Programs				
	PAT			
	PMT PIDs			
	SDT			
Conditional access				
	CAT			
Networks				
	NIT - This			
	NIT - Other			
Time				

Table 2-19: ISDB-T SI/PSI nodes (Cont.)

Primary node	Subsidiary node 1	Subsidiary node 2	Subsidiary node 3	Subsidiary node 4
	TOT			
EPG				
	This TS			
		SDT Actual		
		H		
			Service (number, name)	
				Now/Next (EIT P/F)
				Basic Schedule (EIT schedule)
				Extended Schedule (EIT schedule)
		M		
			Service (number, name)	
				Now/Next (EIT P/F)
				Basic Schedule (EIT schedule)
				Extended Schedule (EIT schedule)
		L		
			Service (number, name)	
				Now/Next (EIT P/F)
				Basic Schedule (EIT schedule)
				Extended Schedule (EIT schedule)
SDTT				
	SDTT(H)			
		Maker id/model id +		
	SDTT(L)			
		Maker id/model id +		
Other tables				

Glossary

ARIB
Association of Radio Industries and Businesses

ASI
Asynchronous Serial Interface

ATSC
Advanced Television Systems Committee

BAT
Bouquet Association Table

CAT
Conditional Access Table

CRC
Cyclic Redundancy Check

CSV
Comma Separated Values

CVCT
Cable Virtual Channel Table

DVB
Digital Video Broadcasting

EIT
Event Information Table

EMM
Entitlement Management Message

ETT
Extended Text Table

IIP
ISDB-T Information Packet

ISDB
Integrated Services Digital Broadcasting

MGT
Master Guide Table

MPEG
Moving Picture Experts Group

NIT
Network Information Table

PAT
Program Association Table

PCI
Peripheral Component Interconnect

PCR
Program Clock Reference

PID
Packet Identifier

PMT
Program Map Table

PSIP
Program and System Information Protocol (ATSC)

PTS
Presentation Time Stamp

RRT
Rating Region Table

RTM
Real-Time Monitor

RUI
Remote User Interface

SDT
Service Description Table

SI
Service Information (DVB)

SMPTE
Society of Motion Picture and Television Engineers

SNMP
Simple Network Management Protocol

SSI
Synchronous Serial Interface

STT
System Time Table

TEF
Transport Error Flag

TMCC
Transmission and Multiplexing Configuration Control (ISDB-S)

TOT
Time Offset Table

TSDT
Transport Streams Description Table

TVCT
Terrestrial Virtual Channel Table

TVRO
Television Receive Only

UTC
Coordinated Universal Time

VCT
Virtual Channel Table

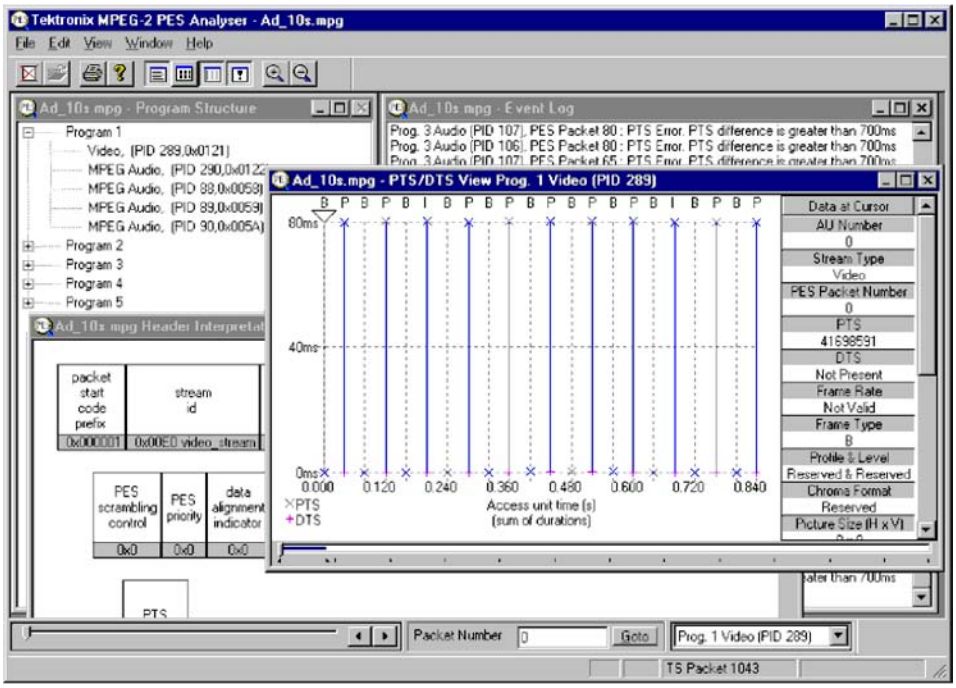
VSB
Vestigial sideband

XML
Extensible Markup Language

Packetized Elementary Stream Analyzer

Getting Started

The Packetized Elementary Stream (PES) Analyzer performs a series of user selectable conformance tests on a previously recorded file. Files can be interpreted according to either the ATSC or DVB standards. Once the file is analyzed analyzed users can view the results of the selected tests and browse through the content of the PES packets.



Information can be viewed in graphical and textual formats. To analyze and view the Transport Stream packets, use the companion program TS Analyzer, which can be run at the same time as this PES Analyzer.

The functionality provided includes:

- Display of program structure showing the programs contained within the transport multiplex and the PES streams which make up each program.
- Display an interpretation of PES packet for individual packets.
- Hexadecimal representation of PES packet.
- Extraction and display of Presentation Time Stamp (PTS) and Decoding Time Stamp (DTS) information from the PES packet header.

- Display of access unit information for video and audio access units.

NOTE. *The examples shown in this chapter are taken from both ATSC and DVB compliant transport streams. An example of each type is sometimes shown as a reminder that both standards are supported or where a difference needs explanation.*

Starting the Program

Start the program by selecting the PES Analyzer option from the Start > Programs menu or by double clicking on the PES Analyzer shortcut on the desktop.

Initial Appearance

Once the program has started and is ready for use it will open a Main Window. When the program first starts it looks as follows:

The Toolbar (row of buttons above the dark gray area of the empty window) may be hidden from view, moved to a separate window or moved to either side or the bottom of the main window.

The Status Line at the very bottom of the window may be hidden from view. Because no file is open, it is displaying a message that the TS packet number is Not Valid.

Above the Status line is the Slider Bar. This has three groups of controls for selecting streams and packets within a file. This may be moved to the top of the window.

Initial Menu Options

PES Analyzer presents different menus and options, depending on whether or not a file is open for analysis. The menu options available when no file is open, are as follows:

***NOTE**. A check mark next to an option indicates that the window or toolbar is currently visible or enabled, no check mark means that it is hidden or disabled.*

File Menu Options. The File menu contains the menu options listed in Table 3–1.

Table 3-1: File menu options

Command	Function
Open...	Opens an MPEG file for analysis. The program opens the file selection dialog allowing the user to choose the required file.
Print Setup ...	Opens a dialog for selecting which printer and associated options to use.
1 <filename> 2 <filename> 3 <filename> 4 <filename>	A list of the four most recently analyzed files. If the program has recently been installed the list may be empty or hold less than four files. Selecting a filename opens that file for analysis.
Exit	Finishes running the program.

View Menu Options. The View menu contains the menu options listed in Table 3–2.

Table 3-2: View menu options

Command	Function
Toolbar	Displays or hides the toolbar.
Status Bar	Displays or hides the status bar.

Settings Menu Options. The Settings menu contains the menu options listed in Table 3–3.

Table 3-3: Settings menu options

Command	Function
Test Options	Opens a dialog for setting the Conformance Test Options for analyzing and interpreting the PES information in stream files.

Options Menu Options. The Options menu contains the menu options listed in Table 3–4.

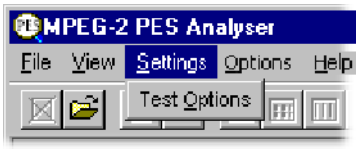
Table 3-4: Options menu options

Command	Function
Limit Repeat Errors	Lists the first 20 occurrences of each error type in the event log.

Options

The MPEG and ATSC Conformance Test Options for MPEG and ATSC may not be modified when a file is open. To change them, all files must be closed, the test options modified, and the file opened again.

Select Test Options from the Settings menu to open the Conformance Tests dialog.

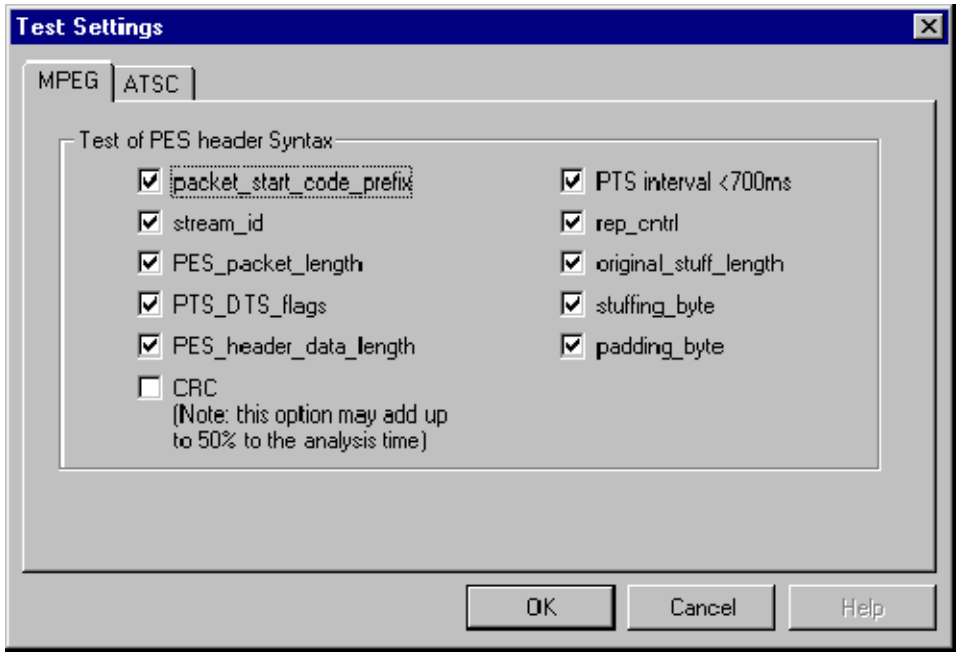


***NOTE**. The Settings Menu is only available when there is no file open. It is hidden when a file is opened and redisplayed when the file is closed.*

Conformance Tests

The dialog box contains two tabbed pages containing tests relating to MPEG and ATSC files, respectively. Note that the MPEG tests are sufficient for DVB streams.

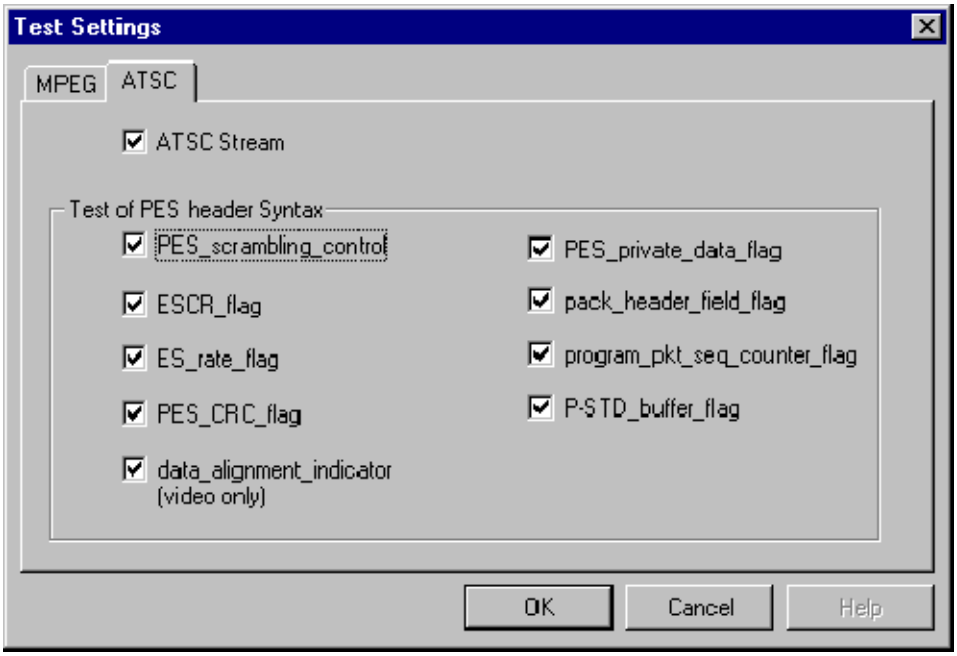
Test of PES Header Syntax (MPEG). The tests of PES header Syntax are based on the conformance requirements laid down in the standards document ISO/IEC 13818-4 for Packetized Elementary Streams. Each check box uses the same name for a particular test as the standard. For example, to test conformance to the standard for the length of PES packets select the PES_packet_length option.



A check mark shows that a test is selected and an empty check box indicates that the test will not be performed.

Test of PES Header Syntax (ATSC). When the ATSC Stream box is checked, selected streams are interpreted according to the ATSC standards, A/52 and A/53.

A check mark shows that a test is selected and an empty check box indicates that the test will not be performed.



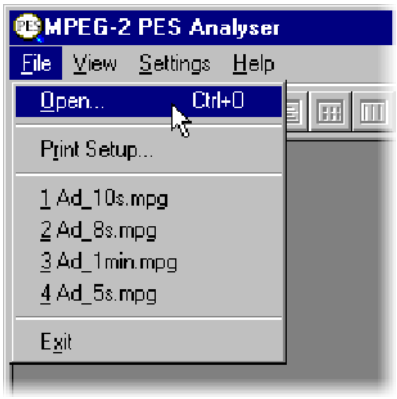
For streams in a DVB standard stream, leave the ATSC Stream option unchecked. The ATSC Stream option is disabled (grayed out) if the software license is only for the DVB standard.

Opening a File

Any file holding a recorded or synthesized sample of a stream can be opened for PES Analysis by this program. To analyze the Transport Stream packets, open the file in the TS Analyzer. A file can be opened by both the TS and PES Analyzers at the same time.

Opening a File from the Menus and Toolbar

To open a file select the Open... option from the file menu. If the required file is in the list of recently analyzed files then it can be opened from the list to save using the Open file dialog. Alternatively, use the Ctrl+O keyboard shortcut.

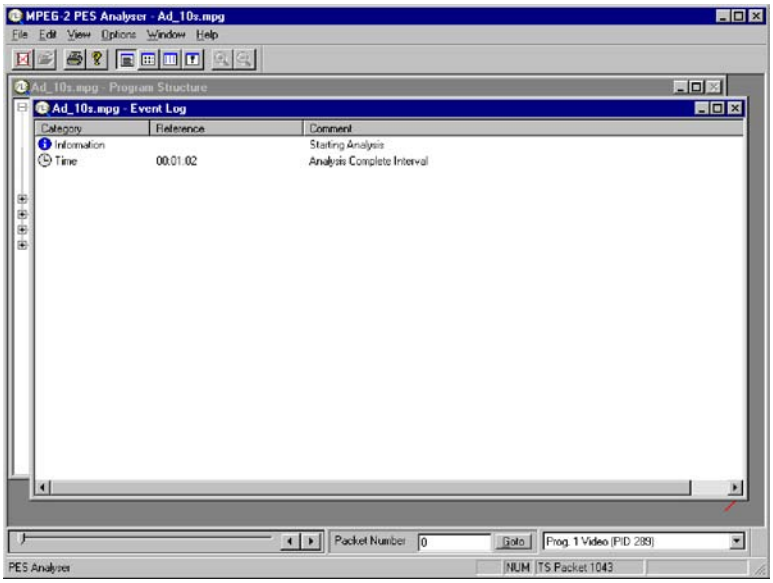


There is also a shortcut button available on the Toolbar for opening a file, which has the standard file open symbol:

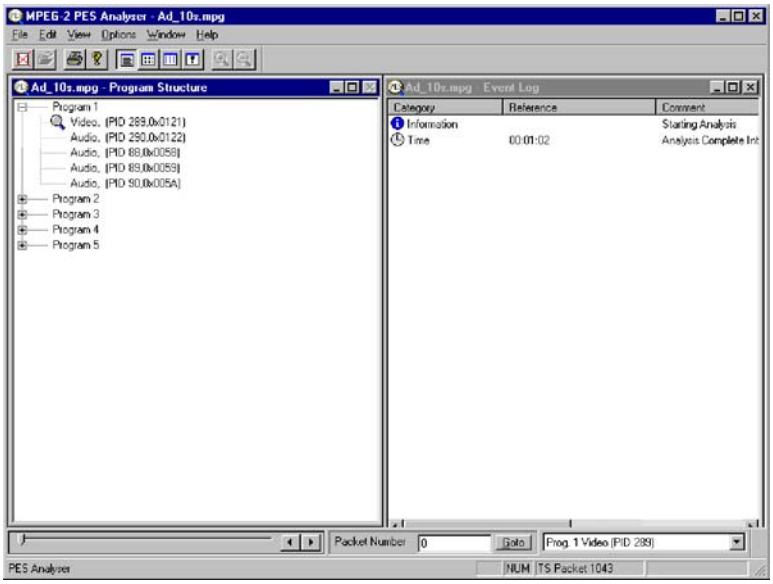
Once a file is open this button will be disabled, which is shown by being “grayed out”.

Window Layout

Program Structure and Event Log windows are opened as soon as the file is opened. The layout of the windows will have been saved from the last time the program was used. If the program has just been installed, the windows will be in the application default Cascade arrangement, which looks like this:



Many users rearrange the windows so that the Program Structure and Event Log windows do not overlap. The examples in this manual often use this arrangement:

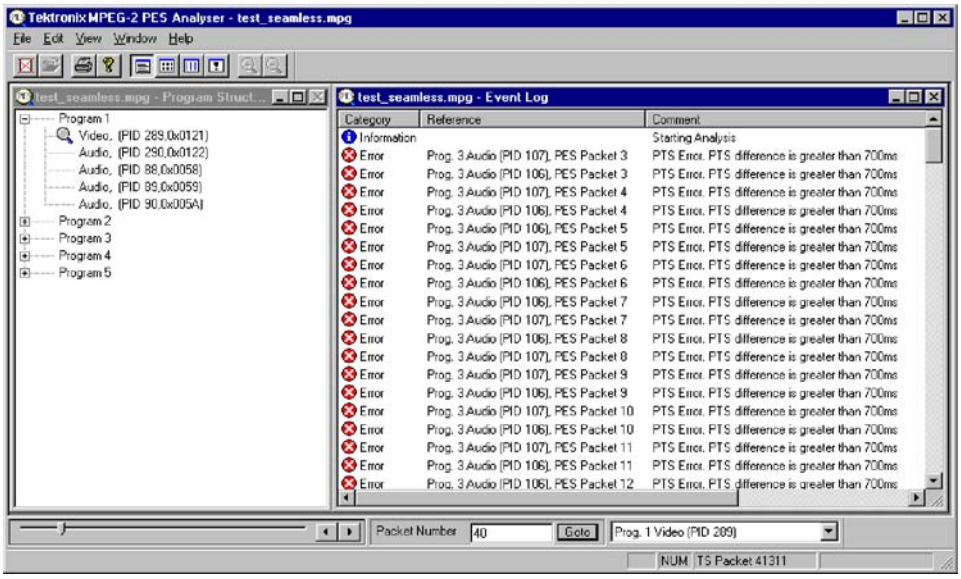


***NOTE**. The above example is from a transport stream interpreted and labeled according to the DVB standard. If the ATSC Stream option is set the elementary streams will be interpreted and labeled according to the ATSC standard. For example: audio streams would be labeled AC-3 Audio, instead of Audio or AAC Audio.*

PES Analysis

The PES Analyzer program now starts to analyze the file for conformance to the selected tests. Due to the very efficient algorithms used by the program, it will analyze large files in a few minutes. Other algorithms have been seen to take much longer. The rightmost pane in the Status Bar shows a progress indicator during Analysis.

As the file is analyzed messages are written in the Event Log and the structure diagram is drawn in the Program Structure window. When the processing is done an “Analysis Complete” message is written in the Event Log.


Tektronix MPEG-2 PES Analyser - test_seamless.mpg
File Edit View Window Help
test_seamless.mpg - Program Struct...
Program 1
Video, (PID 289,0x0121)
Audio, (PID 290,0x0122)
Audio, (PID 88,0x0058)
Audio, (PID 89,0x0059)
Audio, (PID 90,0x005A)
Program 2
Program 3
Program 4
Program 5
test_seamless.mpg - Event Log
Category Reference Comment
Information Starting Analysis
Error Prog. 3 Audio (PID 107), PES Packet 3 PTS Error. PTS difference is greater than 700ms
Error Prog. 3 Audio (PID 106), PES Packet 3 PTS Error. PTS difference is greater than 700ms
Error Prog. 3 Audio (PID 107), PES Packet 4 PTS Error. PTS difference is greater than 700ms
Error Prog. 3 Audio (PID 106), PES Packet 4 PTS Error. PTS difference is greater than 700ms
Error Prog. 3 Audio (PID 106), PES Packet 5 PTS Error. PTS difference is greater than 700ms
Error Prog. 3 Audio (PID 107), PES Packet 5 PTS Error. PTS difference is greater than 700ms
Error Prog. 3 Audio (PID 107), PES Packet 6 PTS Error. PTS difference is greater than 700ms
Error Prog. 3 Audio (PID 106), PES Packet 6 PTS Error. PTS difference is greater than 700ms
Error Prog. 3 Audio (PID 106), PES Packet 7 PTS Error. PTS difference is greater than 700ms
Error Prog. 3 Audio (PID 107), PES Packet 7 PTS Error. PTS difference is greater than 700ms
Error Prog. 3 Audio (PID 106), PES Packet 8 PTS Error. PTS difference is greater than 700ms
Error Prog. 3 Audio (PID 107), PES Packet 8 PTS Error. PTS difference is greater than 700ms
Error Prog. 3 Audio (PID 107), PES Packet 9 PTS Error. PTS difference is greater than 700ms
Error Prog. 3 Audio (PID 106), PES Packet 9 PTS Error. PTS difference is greater than 700ms
Error Prog. 3 Audio (PID 107), PES Packet 10 PTS Error. PTS difference is greater than 700ms
Error Prog. 3 Audio (PID 106), PES Packet 10 PTS Error. PTS difference is greater than 700ms
Error Prog. 3 Audio (PID 107), PES Packet 11 PTS Error. PTS difference is greater than 700ms
Error Prog. 3 Audio (PID 106), PES Packet 11 PTS Error. PTS difference is greater than 700ms
Error Prog. 3 Audio (PID 106), PES Packet 12 PTS Error. PTS difference is greater than 700ms
Packet Number 40 Goto Prog. 1 Video (PID 289)
NUM TS Packet 41311

Menus and Controls

When a file is open the program presents a different set of menus and options. They change as soon as the Program Structure and Event Log windows appear. For example, the Open file commands are replaced by Close file commands.

Toolbar

The Toolbar provides a set of convenient shortcuts for the more frequently used menu options. The available commands are:

Closes the current file. This button becomes enabled the moment a file is opened and analysis starts. If the wrong file is being opened, or the wrong options are selected, clicking on the button will abandon the analysis and close the file.

Open a file. This button is disabled when a file is open.

Print the contents of the current window.

Opens a dialog which displays the program version number.

Toggles the Event Log window. When the button is in this state the window is not visible and clicking on the button will open the Event Log.

Toggles the Packet Hex View window. When the button is in this state the window is not visible and clicking on the button will open the Hex View.

Toggles the PTS/DTS View window. When the button is in this state the window is not visible and clicking on the button will open the PTS/DTS View.

Toggles the Header Interpretation window. When the button is in this state the window is not visible and clicking on the button will open the Header Interpretation.

Zoom In on data in the PTS/DTS View. This button is only enabled when the PTS/DTS View is the current window.

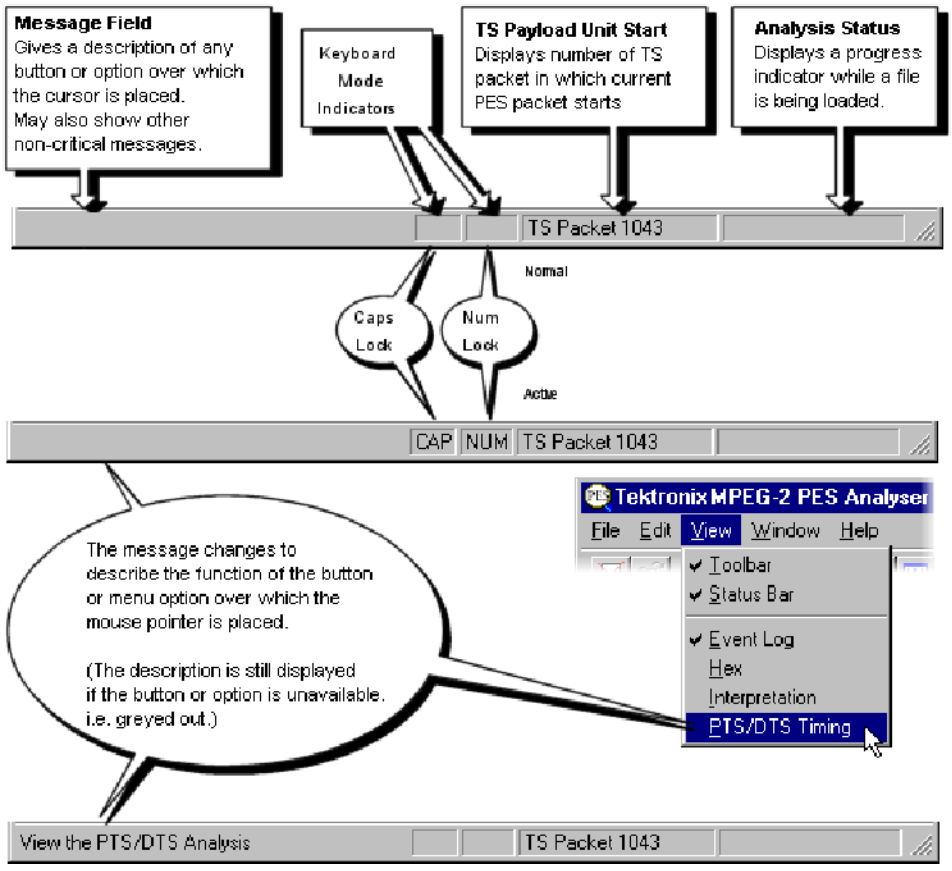
Zoom Out from the data in the PTS/DTS View. This button is only enabled when the PTS/DTS View is the current window.

The Toolbar can be dragged off the edge of the main window into a floating pallet. To do this click on the background inside the Toolbar, that is, not on one of the buttons, and drag into the main window area. The result is a self-contained window which looks like this:

To replace the Toolbar on the window border drag it over the border until the outline changes shape. It can be placed on the top, bottom, left or right edges.

Status Bar

The Status Bar may be hidden from view, but if visible is always at the bottom of the main window. It displays the following information about the program and keyboard states:

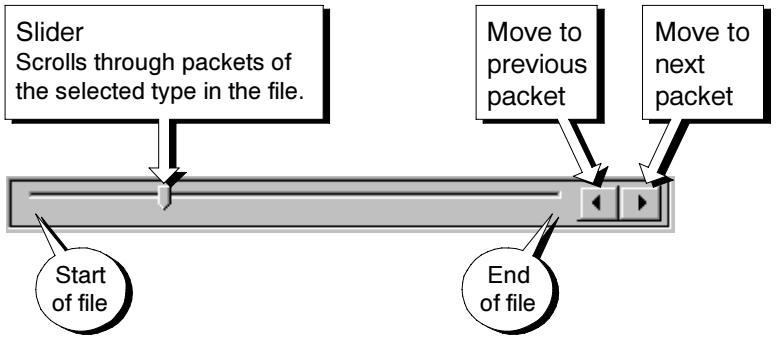

Message Field
Gives a description of any button or option over which the cursor is placed.
May also show other non-critical messages.
Keyboard Mode Indicators
TS Payload Unit Start
Displays number of TS packet in which current PES packet starts
Analysis Status
Displays a progress indicator while a file is being loaded.
TS Packet 1043
Normal
Caps Lock
Num Lock
Active
CAP
NUM
TS Packet 1043
Tektronix MPEG-2 PES Analyser
File Edit View Window Help
Toolbar
Status Bar
Event Log
Hex
Interpretation
PTS/DTS Timing
The message changes to describe the function of the button or menu option over which the mouse pointer is placed.
(The description is still displayed if the button or option is unavailable, i.e. greyed out.)
View the PTS/DTS Analysis
TS Packet 1043

Slider Bar

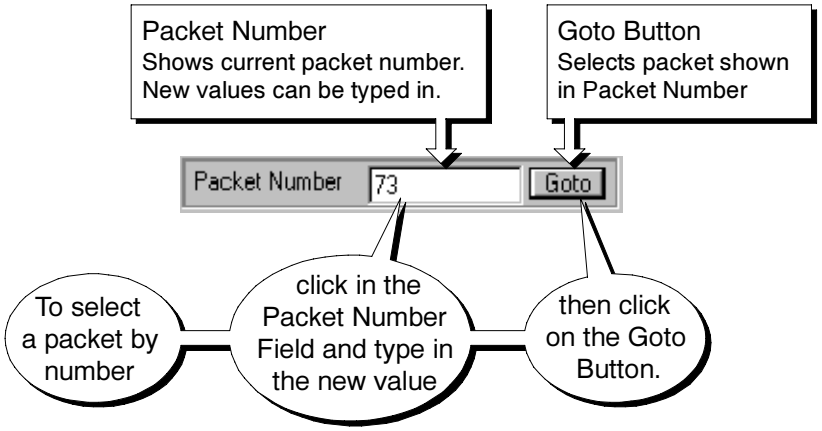
The Analyzer can display the contents of any PES packet in the currently loaded file. Packets are numbered, within a PID, according to their position in the file; the first PES packet of each PID being PES packet 0 (zero). The Slider Bar displays the packet number and the PID for the current packet.

The slider bar controls are as follows:

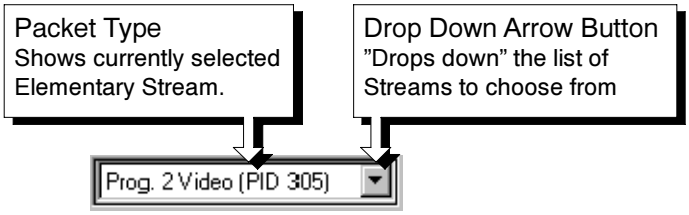
Slider


Slider
Scrolls through packets of the selected type in the file.
Move to previous packet
Move to next packet
Start of file
End of file

Packet number


Packet Number
Shows current packet number. New values can be typed in.
Goto Button
Selects packet shown in Packet Number
Packet Number
73
Goto
To select a packet by number
click in the Packet Number Field and type in the new value
then click on the Goto Button.

Packet Type - Elementary Stream

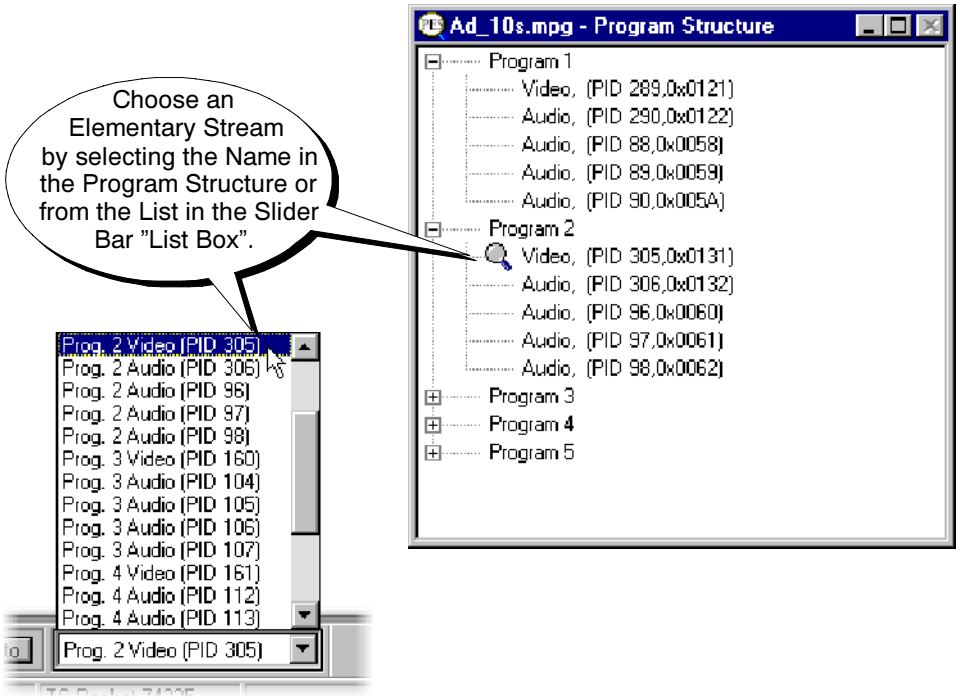

Packet Type
Shows currently selected Elementary Stream.
Drop Down Arrow Button
"Drops down" the list of Streams to choose from
Prog. 2 Video (PID 305)

Like the Toolbar the Slider Bar can be dragged from the edge of the main window into a floating pallet; to do this click on the background inside the Slider Bar and drag it into the main window area. The result is a self contained window which looks like this:

To replace the Slider Bar on the window border drag it over the border until the outline changes shape. Unlike the Toolbar it can only be placed on either the top or bottom edges.

Selecting Packet Type

The Slider and Packet Number can only select packets in the currently selected program stream. The stream is indicated in the Packet Type drop-down list and by the magnifying glass symbol, , in the Program Structure window. A new stream may be selected from either the list box or the window.


Choose an Elementary Stream by selecting the Name in the Program Structure or from the List in the Slider Bar "List Box".
Ad_10s.mpg - Program Structure
Program 1
Video, (PID 289,0x0121)
Audio, (PID 290,0x0122)
Audio, (PID 88,0x0058)
Audio, (PID 89,0x0059)
Audio, (PID 90,0x005A)
Program 2
Video, (PID 305,0x0131)
Audio, (PID 306,0x0132)
Audio, (PID 96,0x0060)
Audio, (PID 97,0x0061)
Audio, (PID 98,0x0062)
Program 3
Program 4
Program 5
Prog. 2 Video (PID 305)
Prog. 2 Audio (PID 306)
Prog. 2 Audio (PID 96)
Prog. 2 Audio (PID 97)
Prog. 2 Audio (PID 98)
Prog. 3 Video (PID 160)
Prog. 3 Audio (PID 104)
Prog. 3 Audio (PID 105)
Prog. 3 Audio (PID 106)
Prog. 3 Audio (PID 107)
Prog. 4 Video (PID 161)
Prog. 4 Audio (PID 112)
Prog. 4 Audio (PID 113)
Prog. 2 Video (PID 305)

Menus and Options

***NOTE**. A check mark next to an option indicates that the window or toolbar is currently visible or enabled, no check mark means that it is hidden or disabled.*

File Menu options

The File menu contains the menu options listed in Table 3–5.

Table 3-5: File menu options

Command	Function
Close	Closes the current file. This option is available as soon as analysis starts. If the wrong file is being opened, or the wrong Conformance Tests are being run, selecting this option will abandon the analysis and close the file.
Print	Prints contents of the current window.
Print Setup	Selects printer and configuration.
Exit	Closes any file that is open and terminates execution the program.

Edit Menu options

The Edit menu contains the menu options listed in Table 3–6.

Table 3-6: Edit menu options

Command	Function
Copy	Copies the contents of the current window to the MS Windows™ Clipboard, from which it can be pasted into a document in another application.
Copy TS Packet	Allows the user to select an AU (access unit) within the PES Analyzer, and then copy the TS packet number onto the Windows clipboard. The Stream Analyzer may then be started and Paste TS packet selected to go to the packet number retrieved from the clipboard.

View Menu options

The View menu contains the menu options listed in Table 3-7.

Table 3-7: View menu options

Command	Function
Toolbar	Shows or hides the Toolbar, which provides a set of convenient shortcuts for the more frequently used menu options.
Status Bar	Shows or hides the Status Bar.
Event Log	Shows or Hides the Event Log.
Hex	Shows or Hides the Hex View.
Interpretation	Shows or Hides the Packet Interpretation view.
PTS/DTS Timing	Shows or Hides the PTS/DTS Timing Analysis window.

Options Menu options

The Options menu contains the menu options listed in Table 3-8.

Table 3-8: Options menu options

Command	Function
Limit Repeat Errors	Only lists the first 20 occurrences of each error type in the event log.

Window Menu options

The Window menu contains the menu options listed in Table 3-9.

Table 3-9: Window menu options

Command	Function
Cascade	Arranges all the windows so that they are neatly stacked; only the title bars show behind the active window.
Tile	Reduces and moves windows so that they can all be seen at once.
Arrange Icons	Aligns icons of any minimized windows at the bottom of the program's main window.
1 <window title> 2 <window title> 3 ... etc.	Makes the named window active, putting it on top of any windows which had been hiding all or part of it.

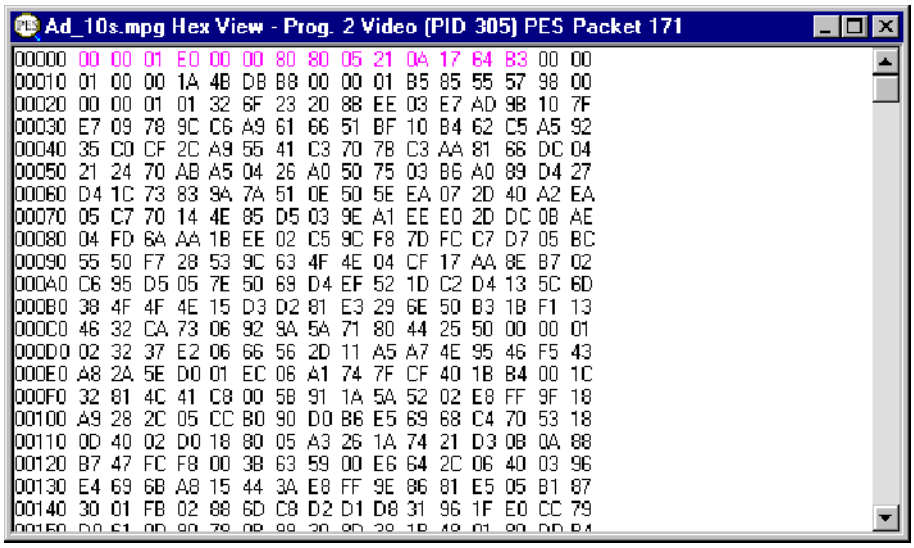
Help Menu options

The Help menu contains the menu options listed in Table 3–10.

Table 3- 10: Help menu options

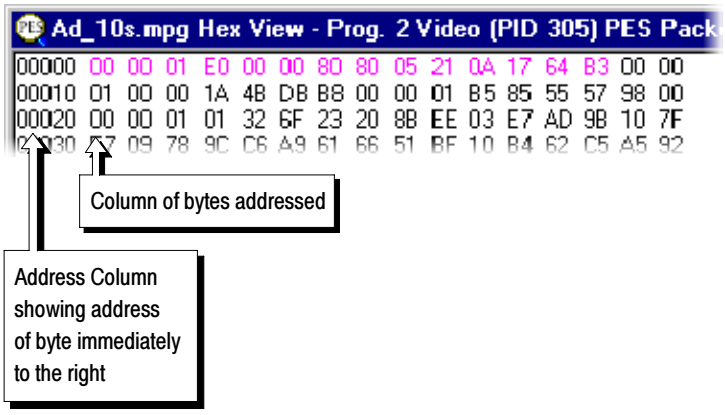
Command	Function
About PES Analyzer…	Opens a dialog that displays the program version number.

Packet Hex View



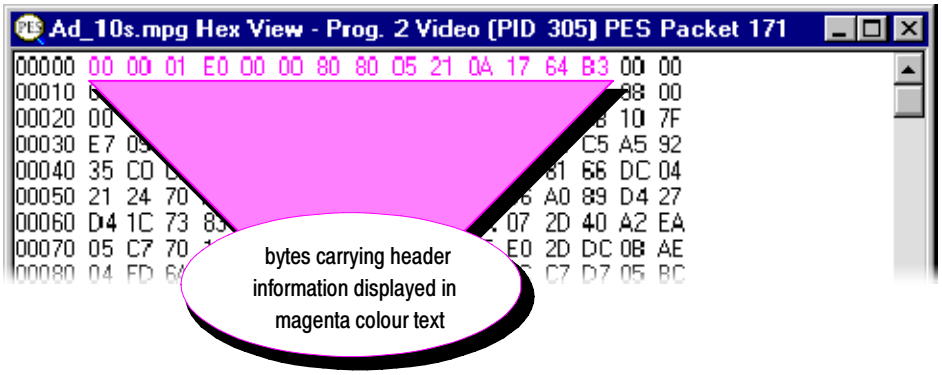
This is the lowest level view of the PES Packet data. It displays the contents of every byte in hexadecimal. Each byte is represented as a pair of hexadecimal digits. The window may be resized to display 16, 32, 48, … bytes of information on each row.

The four digit numbers in the left most column are the addresses of the first (that is, leftmost) byte in the row. The addresses are shown in hexadecimal.


Ad_10s.mpg Hex View - Prog. 2 Video (PID 305) PES Pack
00000 00 00 01 E0 00 00 80 80 05 21 0A 17 64 B3 00 00
00010 01 00 00 1A 4B DB B8 00 00 01 B5 85 55 57 98 00
00020 00 00 01 01 32 6F 23 20 8B EE 03 E7 AD 9B 10 7F
00030 E7 09 78 9C C6 A9 61 66 51 BF 10 B4 62 C5 A5 92
Column of bytes addressed
Address Column showing address of byte immediately to the right

Packet Header

The Hex View displays the bytes holding PES Packet header information in magenta color text. For example here is a packet containing a PTS field, from a video stream:



The most significant two bits of the eighth byte (that is, the byte at address 0x0007) contain the PTS_DTS_flags. The ninth byte (address 0x0008) contains the PES_header_data_length, which specifies how many additional bytes are present. In the above example:

PTS_DTS_flag = 2

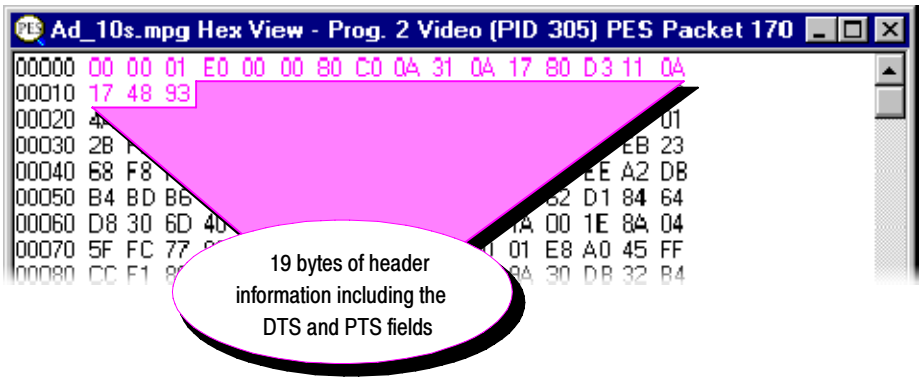
PES_header_data_length = 5

These specify that there is a 5 byte Presentation Time Stamp (PTS) field in the header. The contents of the PTS are 21 0A 17 64 B3 and they follow the PES_header_data_length.

The preceding packet, from the same stream, carried both a PTS and DTS field:

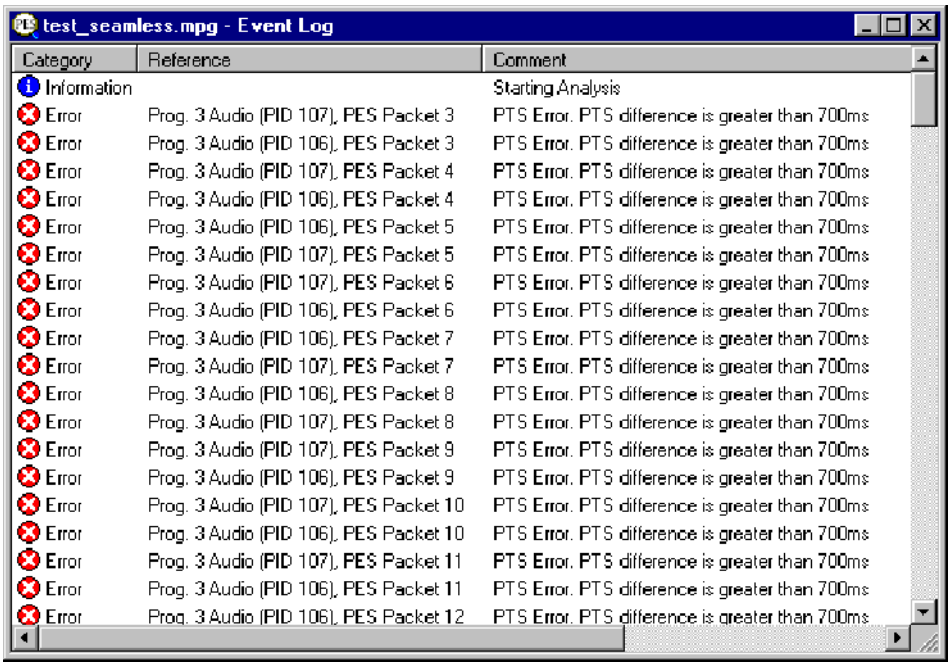
PTS_DTS_flag = 3

PES_header_data_length = 10 (shown as 0A in hexadecimal)


Ad_10s.mpg Hex View - Prog. 2 Video (PID 305) PES Packet 170
00000 00 00 01 E0 00 00 80 C0 0A 31 0A 17 80 D3 11 0A
00010 17 48 93
19 bytes of header information including the DTS and PTS fields

Instead of having to interpret header information from the Hex View, the PES Analyzer provides the Header Interpretation window. This interprets the header and displays the contents, in table form, according to the MPEG-2 standards.

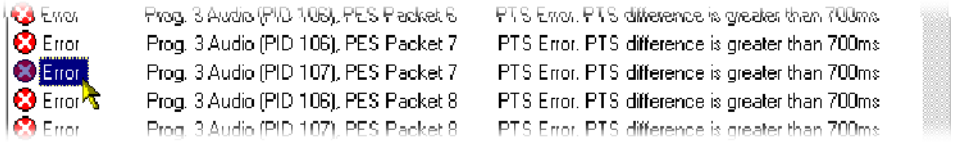
Event Log



The program always opens the Event Log window when it starts to analyze a file. As the file is analyzed the program writes the results to the window as they are produced. When processing finishes an “Analysis Complete” message is appended to the report.

Packet Selection

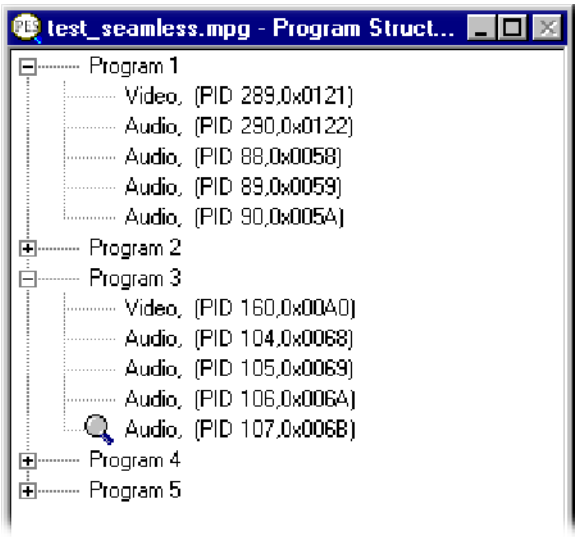
If a warning or error message gives a packet number, that packet may be inspected by selecting the message. For example, here is an extract from a file with PTS errors on two of the Audio streams:


Error Prog. 3 Audio (PID 106), PES Packet 6 PTS Error. PTS difference is greater than 700ms
Error Prog. 3 Audio (PID 106), PES Packet 7 PTS Error. PTS difference is greater than 700ms
Error Prog. 3 Audio (PID 107), PES Packet 7 PTS Error. PTS difference is greater than 700ms
Error Prog. 3 Audio (PID 106), PES Packet 8 PTS Error. PTS difference is greater than 700ms
Error Prog. 3 Audio (PID 107), PES Packet 8 PTS Error. PTS difference is greater than 700ms

Clicking on the message for Prog. 3 Audio (PID 106), PES Packet 78 selects both the program stream and the packet. This is reflected by the Slider Bar, in the Program Structure, Hex View, Header interpretation and PTS/DTS Views.

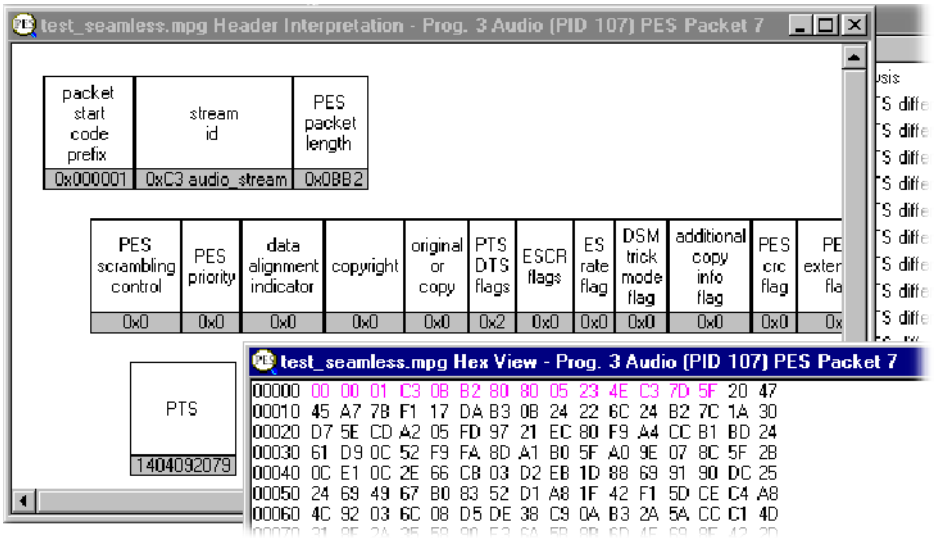
The Slider bar will look like this:

In the program structure view, the magnifying glass icon, , appears on the selected stream:

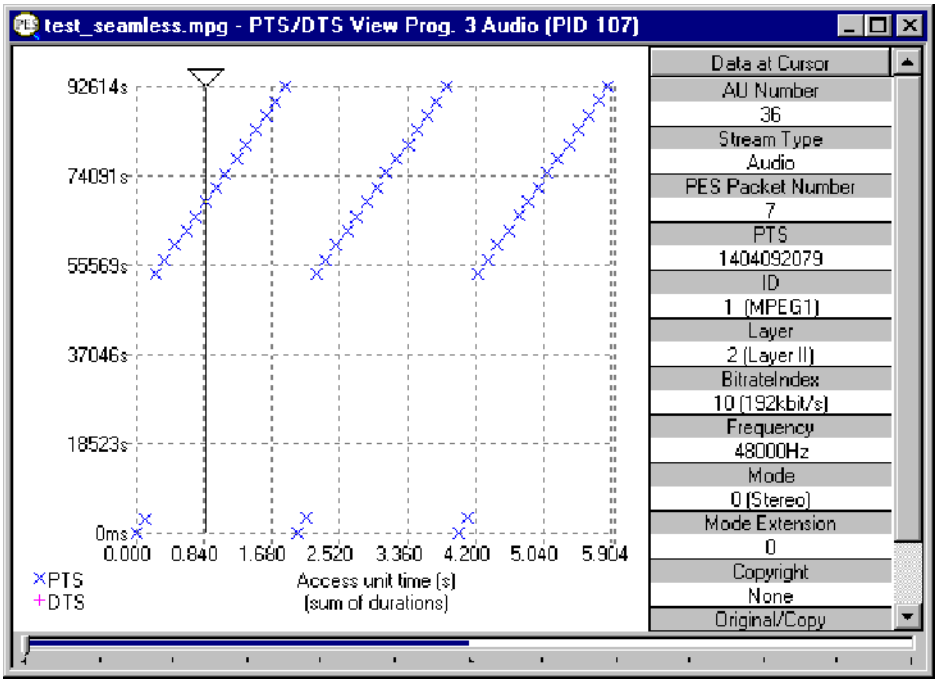


If the Hex View and/or Header Interpretation windows are open they will be updated to show the contents of the selected packet. If the PTS/DTS View window is open the cursor is placed on the packet and the panel showing the Data at Cursor is updated.

Having selected the packet it can now be inspected with other tools. The information in the Header Inspection and Hex View windows will look like this:

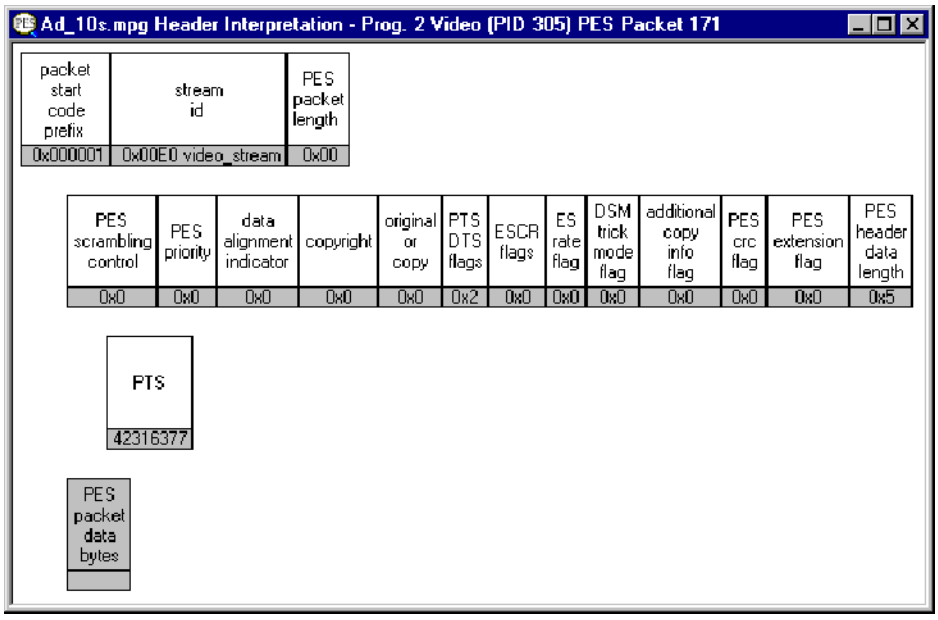

test_seamless.mpg Header Interpretation - Prog. 3 Audio (PID 107) PES Packet 7
packet start code prefix
0x000001
stream id
0xC3 audio_stream
PES packet length
0x0BB2
PES scrambling control
0x0
PES priority
0x0
data alignment indicator
0x0
copyright
0x0
original or copy
0x0
PTS DTS flags
0x2
ESCR flags
0x0
ES rate flag
0x0
DSM trick mode flag
0x0
additional copy info flag
0x0
PES crc flag
0x0
PTS
1404092079
test_seamless.mpg Hex View - Prog. 3 Audio (PID 107) PES Packet 7
00000 00 00 01 C3 0B B2 80 80 05 23 4E C3 7D 5F 20 47
00010 45 A7 7B F1 17 DA B3 0B 24 22 6C 24 B2 7C 1A 30
00020 D7 5E CD A2 05 FD 97 21 EC 80 F9 A4 CC B1 BD 24
00030 61 D9 0C 52 F9 FA 8D A1 B0 5F A0 9E 07 8C 5F 2B
00040 0C E1 0C 2E 66 CB 03 D2 EB 1D 88 69 91 90 DC 25
00050 24 69 49 67 B0 83 52 D1 A8 1F 42 F1 5D CE C4 A8
00060 4C 92 03 6C 08 D5 DE 38 C9 0A B3 2A 5A CC C1 4D

To look at the timing of all the PTS carrying packets, open the PTS/DTS View:



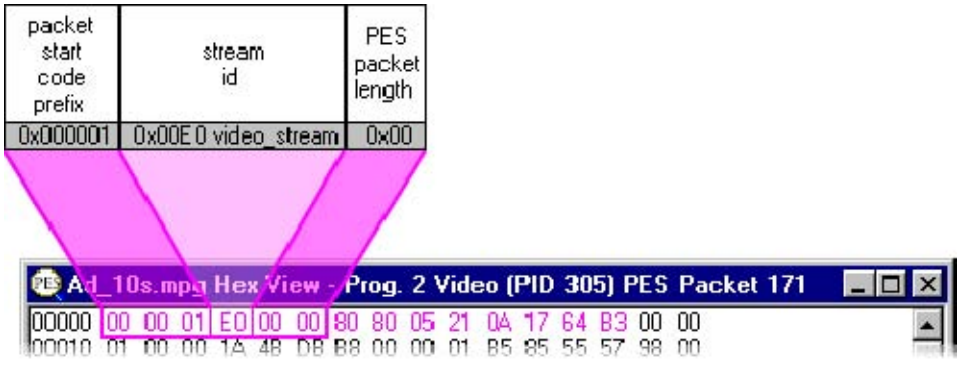
This shows all the PES packets for the selected PID. See the section on the PTS/DTS View for more information on selecting a particular packet.

Packet Header Interpretation

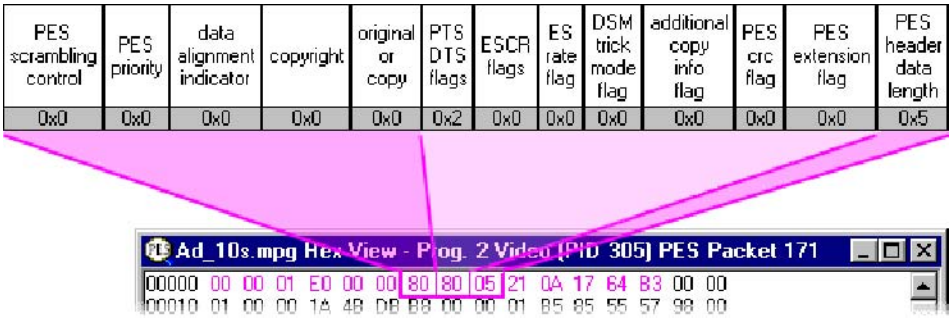


This window interprets and displays the header of the currently selected packet. The above example shows a packet which carries a Presentation Time Stamp (PTS).

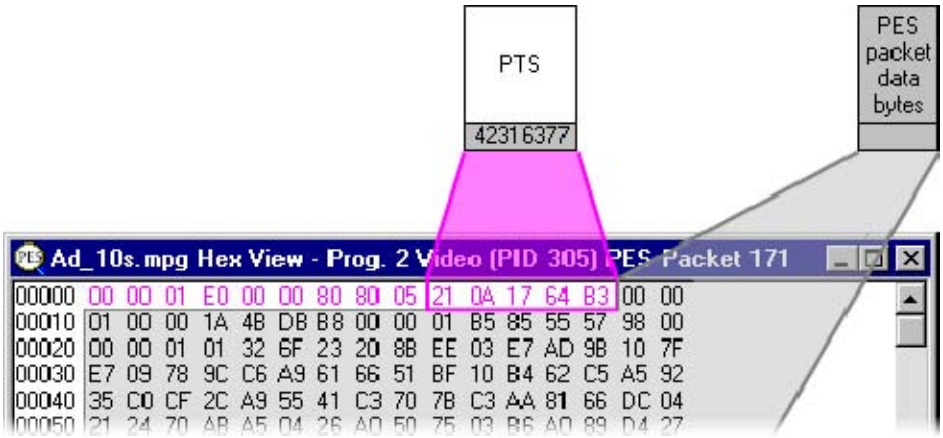
The relationship between the top row of information displayed in the Header Interpretation, for this packet, and the Hex View is:


packet start code prefix
0x000001
stream id
0x00E0 video_stream
PES packet length
0x00
Ad_10s.mpg Hex View - Prog. 2 Video (PID 305) PES Packet 171
00000 00 00 01 E0 00 00 80 80 05 21 0A 17 64 B3 00 00

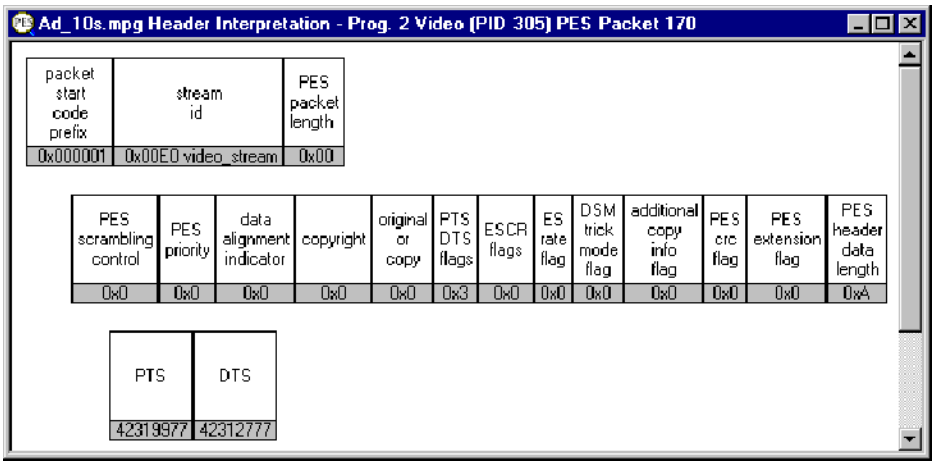
The next row completes the compulsory header information. The mapping between the Header Interpretation and Hex View is:



The last row is a reminder that after the header comes the packet data. Any other rows represent additional fields, such as the Presentation Time Stamp (PTS) carried in this example. The relationship of these rows to the Hex view is:



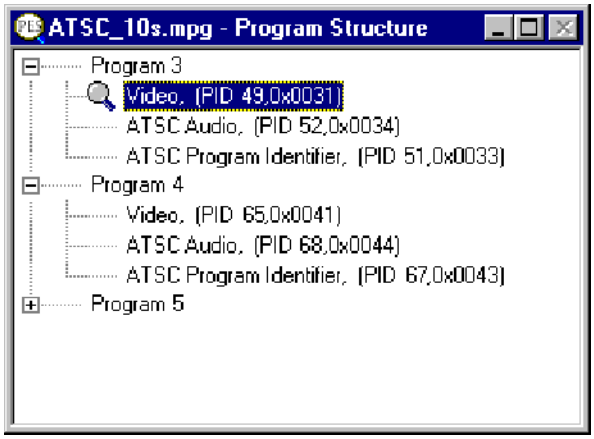
The size of the header depends on the fields it carries. Here is the Header Information view of the preceding packet which carries PTS and DTS fields:



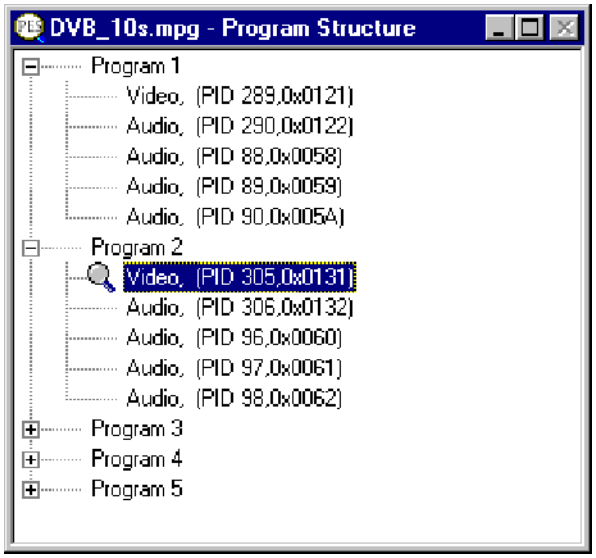
Program Structure

The Program Structure window displays a list of all available programs and the elementary streams that they contain. It shows which stream is currently selected for inspection and may be used to select a different stream.

The example below shows a program structure from a file conforming to the ATSC standard.

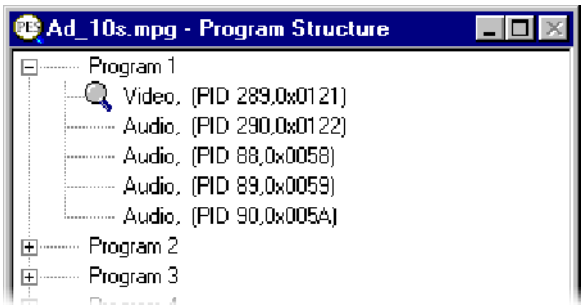


The example below is a program structure from a file that is compliant to the DVB standard.



The Diagram

The Program Structure is displayed by the program as soon as a file is opened. As the file is analyzed, the top levels of a structure diagram are drawn in the window:



An Elementary Stream is selected by default. The Program Structure view shows the selected stream and other streams in the same program. The first program is expanded to show the streams in the next level.

Streams in the other programs are initially hidden from view.

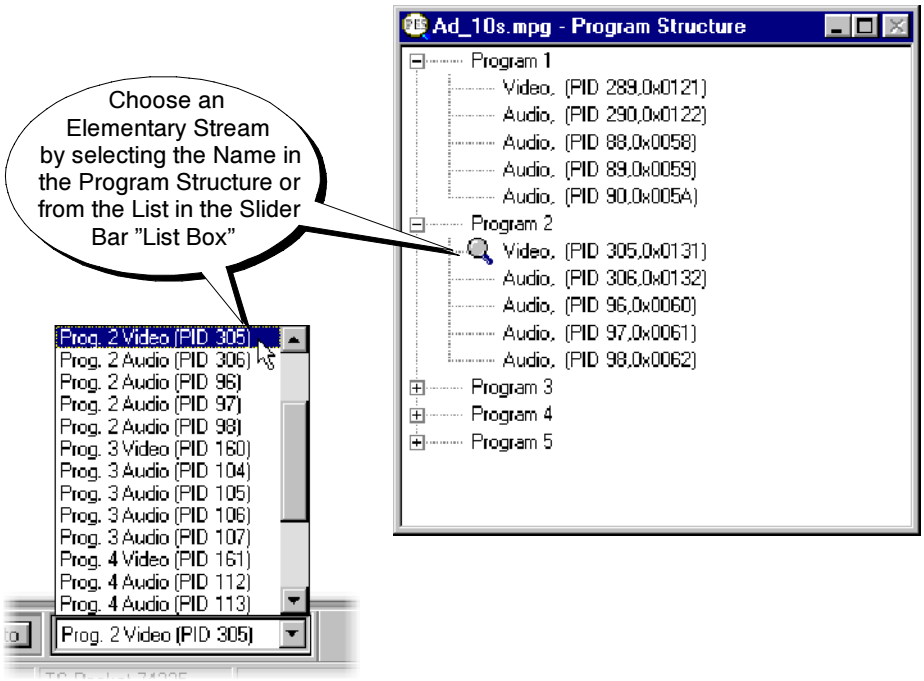
The structure is represented by a tree diagram, with the “root node” or highest level component at the top. Components which contain more information beneath them in the structure are indicated by a square box.

Components that are connected to a branch of the tree without a square box are leaf nodes. In this case the Video and Audio elementary streams are leaf nodes. They display the lowest and finest level of detail.

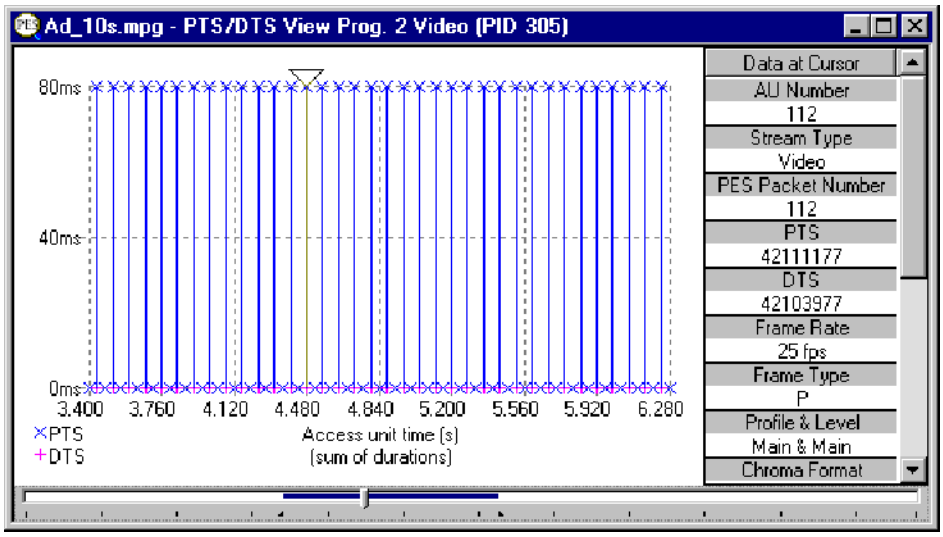
Nodes can be expanded and contracted by clicking on the square box.

Selecting a Packet Type

When a file is first opened and analyzed a stream will be selected by default. The type is indicated by the magnifying glass symbol, , in the Program Structure. It is also displayed in the Packet Type “list Box” on the Slider Bar. A new stream may be selected from either the list box or the window.


Choose an Elementary Stream by selecting the Name in the Program Structure or from the List in the Slider Bar ”List Box”
Ad_10s.mpg - Program Structure
Program 1
Video, (PID 289,0x0121)
Audio, (PID 290,0x0122)
Audio, (PID 88,0x0058)
Audio, (PID 89,0x0059)
Audio, (PID 90,0x005A)
Program 2
Video, (PID 305,0x0131)
Audio, (PID 306,0x0132)
Audio, (PID 96,0x0060)
Audio, (PID 97,0x0061)
Audio, (PID 98,0x0062)
Program 3
Program 4
Program 5
Prog. 2 Video (PID 305)
Prog. 2 Audio (PID 306)
Prog. 2 Audio (PID 96)
Prog. 2 Audio (PID 97)
Prog. 2 Audio (PID 98)
Prog. 3 Video (PID 160)
Prog. 3 Audio (PID 104)
Prog. 3 Audio (PID 105)
Prog. 3 Audio (PID 106)
Prog. 3 Audio (PID 107)
Prog. 4 Video (PID 161)
Prog. 4 Audio (PID 112)
Prog. 4 Audio (PID 113)
Prog. 2 Video (PID 305)

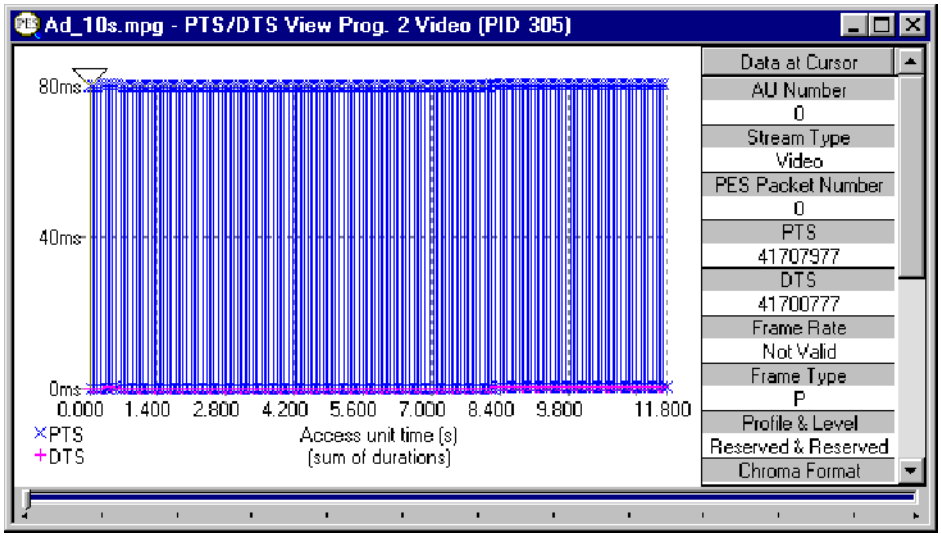
PTS/DTS Timing Analysis



The PTS/DTS View shows timing analysis of the selected stream. The x-axis shows the duration of the stream in seconds. The y-axis shows the differences between the expected and actual DTS values. A vertical blue line is used to show the difference between the PTS and DTS for each Access Unit (AU). Therefore, a compliant stream will exhibit each DTS on the 0ms y-axis. Streams with errors usually exhibit a “stepped” graphical effect.

Any AU in the stream may be selected to view additional information in the panel on the right. If the panel is not tall enough to show all of the information a scroll bar appears.

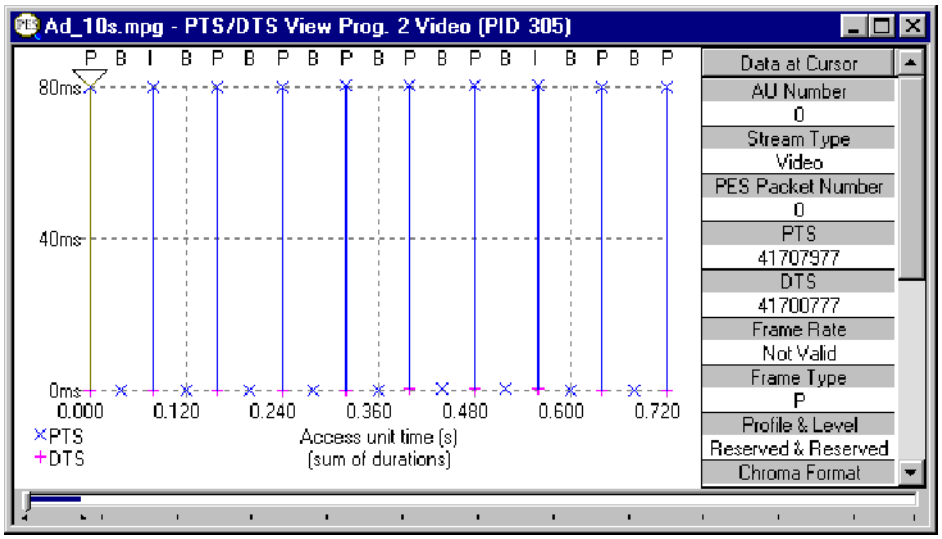
When first opened the entire stream is shown. Even a small file may display data points packed too closely together to be read; for example, here is just under 12 seconds of video:



A longer sample may appear as a solid band of blue.

To see the individual packets or access units click on the Zoom In button on the Toolbar:

In this example, clicking the on the Zoom In button four times gave a much clearer view:

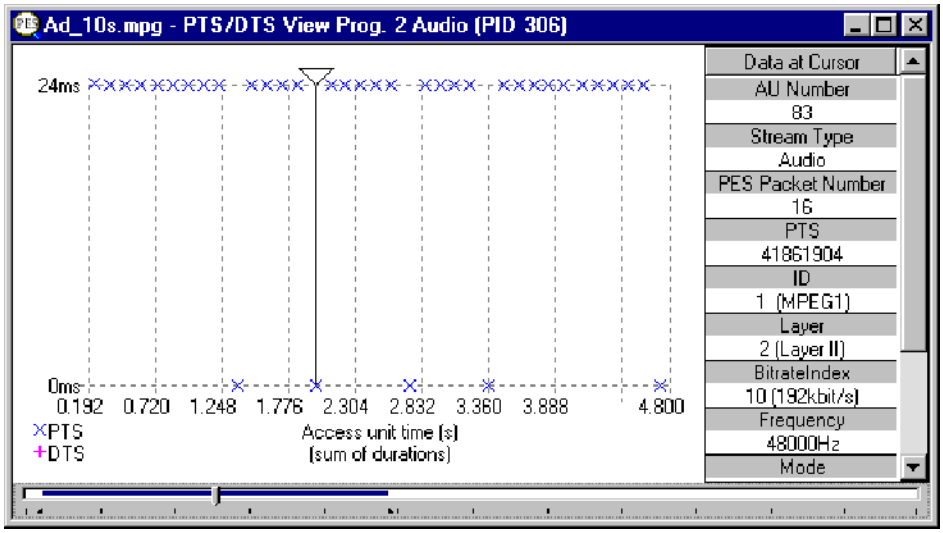


The blue × crosses of Presentation Time Stamps and the magenta + crosses of Decoding Time Stamps can now be differentiated.

To Zoom back out click on the Zoom Out button as many times as required:

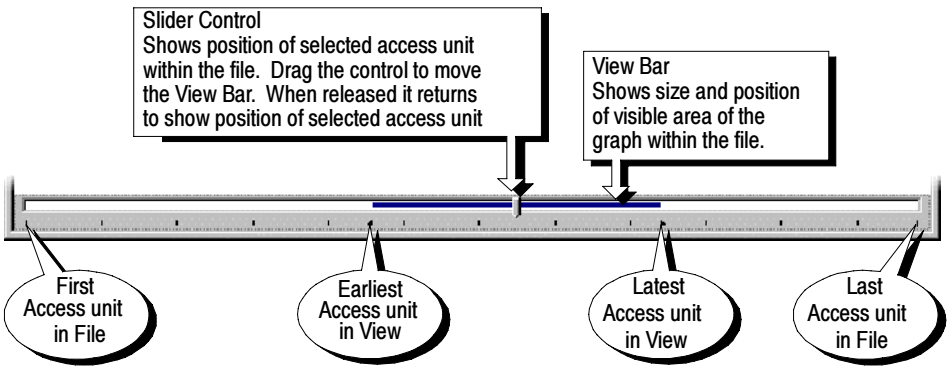
Access Unit Selection

The triangular cursor above the graph indicates the selected access unit. Extra information about that access unit is displayed in the Panel on the right of the Graph.



Scrolling the View

The Slider at the bottom of the window indicates where the displayed packets / access units are in relation to the rest of the file. It can be used to scroll the display through the data in the same way as a standard window scroll bar.


Slider Control
Shows position of selected access unit within the file. Drag the control to move the View Bar. When released it returns to show position of selected access unit
View Bar
Shows size and position of visible area of the graph within the file.
First Access unit in File
Earliest Access unit in View
Latest Access unit in View
Last Access unit in File

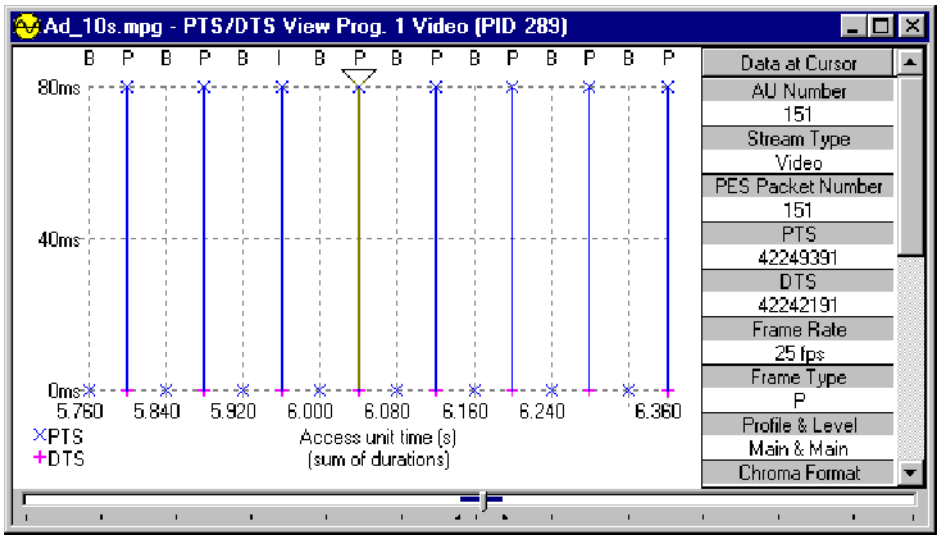
To scroll the stream through the view drag the Slider Control left or right with the mouse. After dragging the Slider Control it returns to the previous position showing the location of the selected access unit.

Click the mouse pointer on the white space either side of the View Bar to center the displayed graph about the currently selected access unit.

When an access unit is selected on the graph, the Slider Control is automatically repositioned within the View Bar. The placement of the Slider Control reflects the position of the selected packet in the field of view.

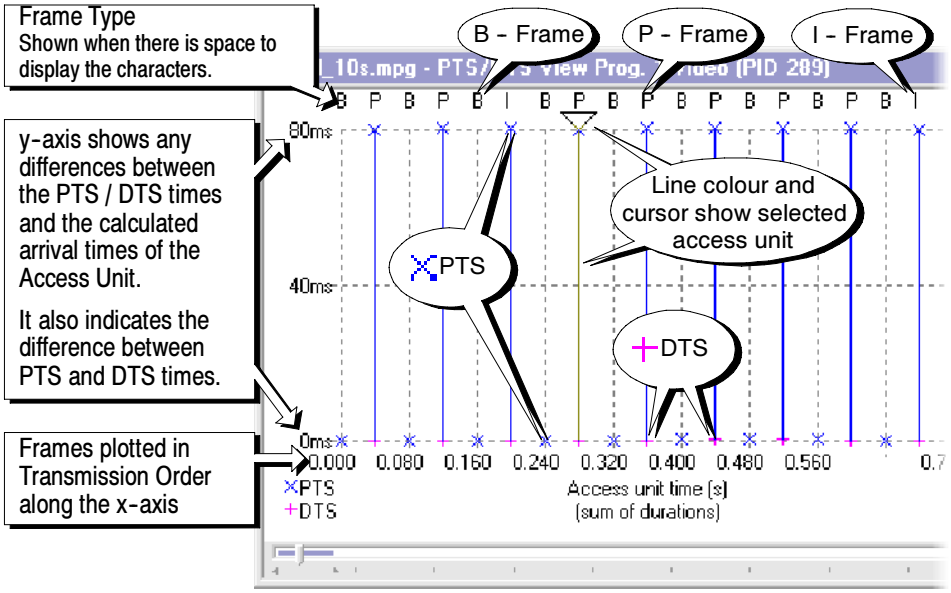
Selecting an Access Unit on the graph also changes the selection for all of the other views to the packet containing that Access Unit.

Video Streams



The panel on the right shows information about the selected access unit. For video streams these are always complete packets. Some of the information shown in the panel is specific to video streams, that is, frame rate and frame type.

The graph shows the frames of video in transmission order analysis and, when “Zoomed In” close enough, the type of each packet plotted along the x-axis. The graph scale is drawn in gray dashed lines. It is the equivalent of the scale or graticule on an oscilloscope or logic analyzer.

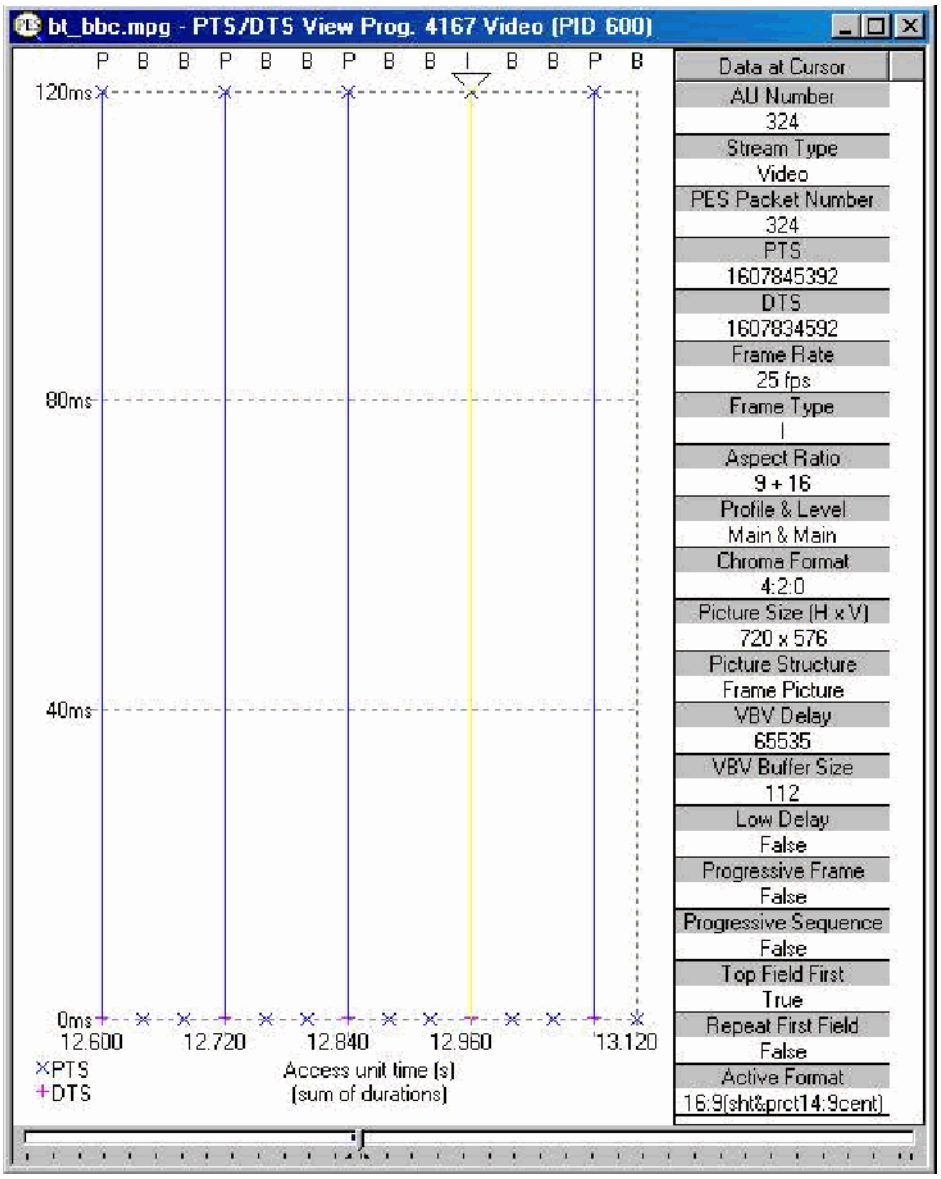

Frame Type
Shown when there is space to display the characters.
y-axis shows any differences between the PTS / DTS times and the calculated arrival times of the Access Unit.
It also indicates the difference between PTS and DTS times.
Frames plotted in Transmission Order along the x-axis
B - Frame
P - Frame
I - Frame
B P B P B I B P B P B P B P B P B I
80ms
40ms
0ms
PTS
DTS
Line colour and cursor show selected access unit
0.000 0.080 0.160 0.240 0.320 0.400 0.480 0.560 0.7
PTS
DTS
Access unit time (s)
(sum of durations)

X-Axis The x-axis shows the nominal time of an access unit. The first access unit displayed is taken to have a nominal time of zero. Each access unit has a nominal duration, calculated from parameters within the elementary stream. These parameters include “low_delay” and “repeat_first_field”, which allow analysis of effects such as 3:2 pulldown. These effects alter the access unit duration, which is nominally equal to a video frame period.

Y-Axis The position on the y-axis of a PTS or DTS shows the relative timing of the timestamps. The first timestamp (PTS, or DTS) is taken to have a y-value of zero. Each Subsequent timestamp has a y-value given by the difference between their timestamp and the first timestamp, less the difference in nominal time of their access unit and the first access unit.

The solid blue vertical lines show the time difference between the PTS and DTS from the same Access Unit.

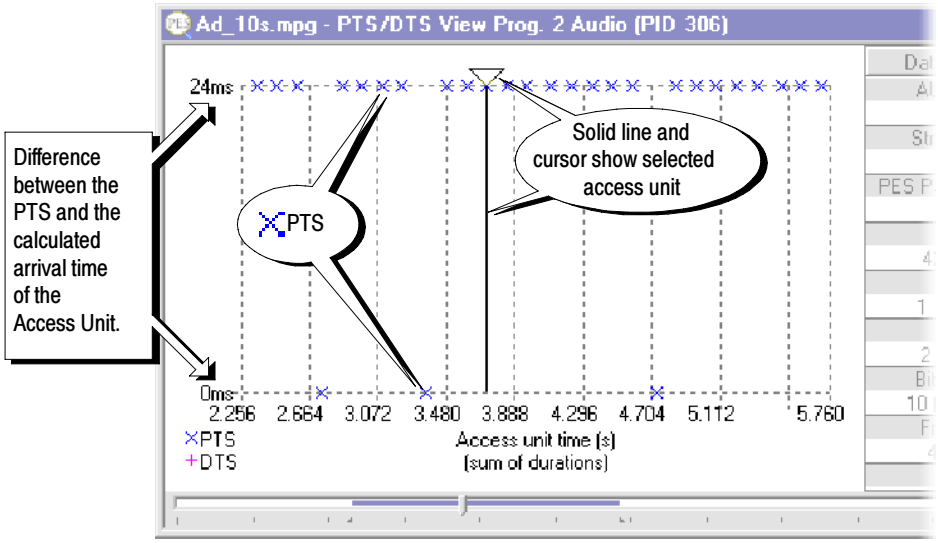
Audio Streams



The panel on the right shows information about the selected access unit. For video streams, these are always complete packets. The frame rate and frame type shown in the panel are specific to video streams. The “Picture Size (H x V)” information is taken from the display_horizontal_size and display_vertical_size values in the sequence display extension. If that is not present, the horizontal_size_value and vertical_size_values in the sequence header, as modified by the sequence header extension values horizontal_size_extension and vertical_size_extension in the sequence header extension are used.

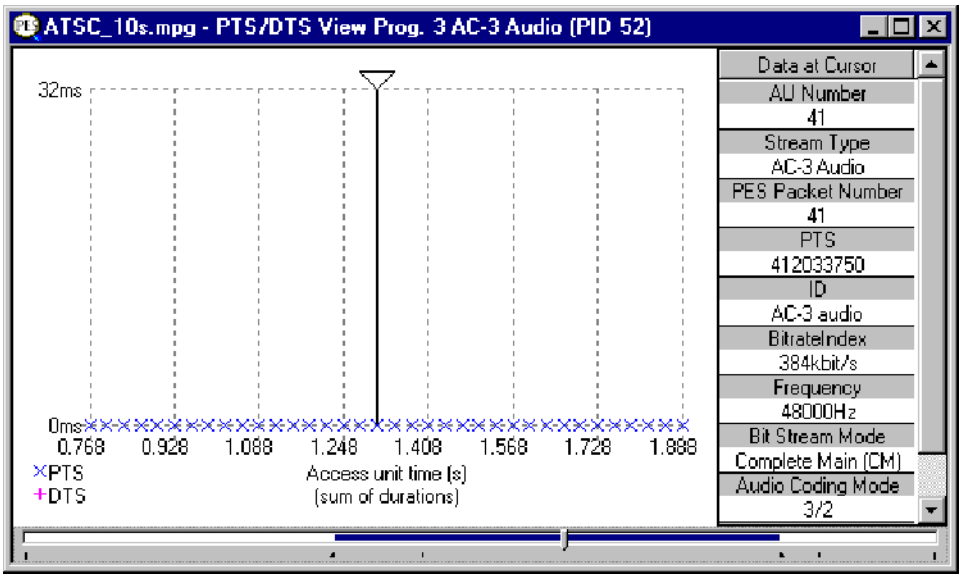
Some of the information shown in the panel is specific to audio streams. AC-3 Audio streams will differ from Audio streams.

The graph shows timing analysis of the PTS. There are no DTS in an audio stream. Select an access unit by clicking on it with the mouse. Clicking between two PTS will select an access unit that does not carry a PTS.



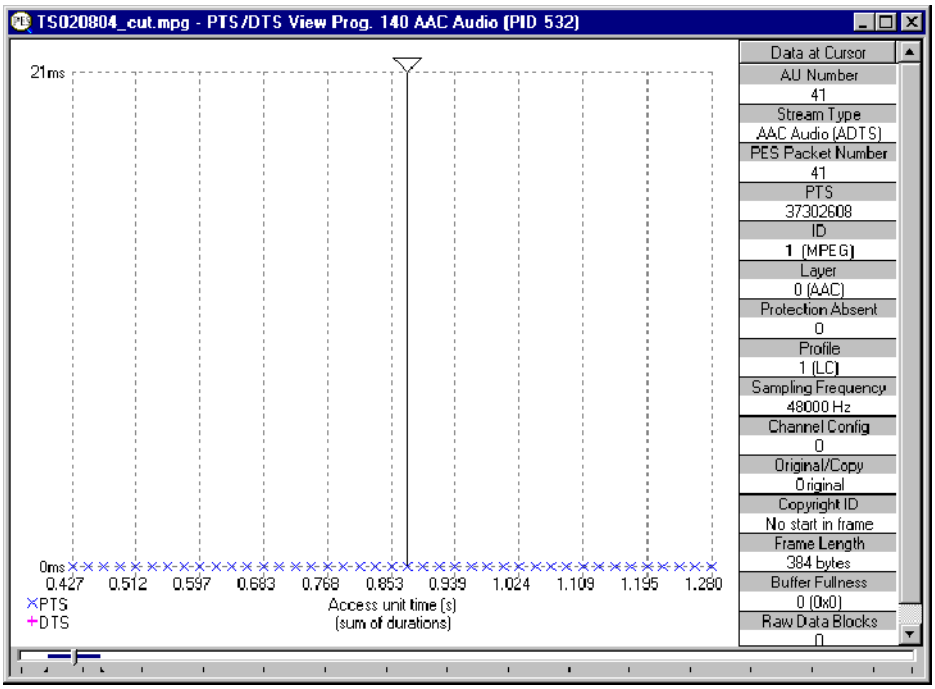
The graph scale is drawn in gray dashed lines for each value on the axis. In this example there are only two values on the y-axis, at 0 ms and 24 ms.

AC-3 Audio Streams



The Data at Cursor panel of the PTS/DTS View shows different information for AC-3 Audio streams. Otherwise the window works in the same way as for Audio streams.

AAC Audio Streams



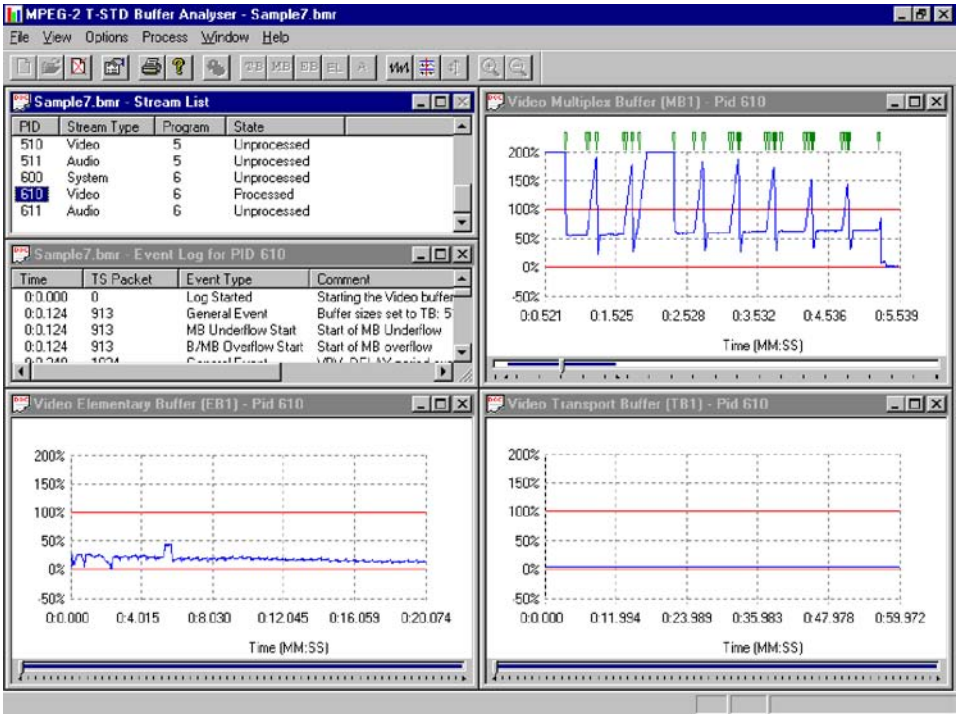
The Data at Cursor panel of the PTS/DTS View shows different information for AAC Audio streams. Otherwise the window works in the same way as for Audio streams.

T-STD Buffer Analyzer

Test Equipment Depot - 800.517.8431 - 99 Washington Street Melrose, MA 02176 - FAX 781.665.0780 - TestEquipmentDepot.com

Getting Started

The T_STD Buffer Analyzer models the behavior of the buffers in the hypothetical Transport Stream System Target Decoder, as specified in ISO/IEC 13818-1. It will process video, audio, and system control streams. The results of the analysis are displayed as graphs of the buffer capacity over time and a log of exceptions and noteworthy events.


MPEG-2 T-STD Buffer Analyser - Sample7.bmr
File View Options Process Window Help
Sample7.bmr - Stream List
PID Stream Type Program State
510 Video 5 Unprocessed
511 Audio 5 Unprocessed
600 System 6 Unprocessed
610 Video 6 Processed
611 Audio 6 Unprocessed
Sample7.bmr - Event Log for PID 610
Time TS Packet Event Type Comment
0:0.000 0 Log Started Starting the Video buffer
0:0.124 913 General Event Buffer sizes set to TB: 5
0:0.124 913 MB Underflow Start Start of MB Underflow
0:0.124 913 B/MB Overflow Start Start of MB overflow
Video Multiplex Buffer (MB1) - Pid 610
200% 150% 100% 50% 0% -50%
0:0.521 0:1.525 0:2.528 0:3.532 0:4.536 0:5.539
Time (MM:SS)
Video Elementary Buffer (EB1) - Pid 610
200% 150% 100% 50% 0% -50%
0:0.000 0:4.015 0:8.030 0:12.045 0:16.059 0:20.074
Time (MM:SS)
Video Transport Buffer (TB1) - Pid 610
200% 150% 100% 50% 0% -50%
0:0.000 0:11.994 0:23.989 0:35.983 0:47.978 0:59.972
Time (MM:SS)

Suitable Streams

Any valid MPEG file, recorded or synthesized, can be processed by this application. A valid file is one that starts on a transport stream (TS) packet boundary (the first byte of the file must contain the first byte of a TS packet).

The Buffer Analyzer will process video, audio, and system control streams that are compliant with the 1996 standard ISO/IEC 13818 parts 1-3.

It will handle transport streams that contain PCR and/or PTS/DTS discontinuities. The PTS/DTS and PCR in a stream must, however, use the same timebase.

Buffer Analyzer is unable to work on scrambled streams. If it fails to make sense of a stream, use TS Analyzer to determine if the stream is scrambled.

Table Handling

Multiple PAT and PMT Versions

Buffer Analyzer forms a list of which elementary streams are present in the transport stream. This is called the Stream List. It creates the Stream List by reading the first occurrence of the Program Association Table (PAT) and Program Map Table (PMT).

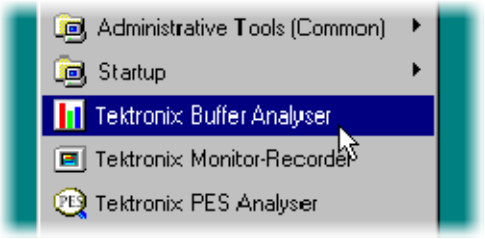
If more than one version of the PAT and/or PMT are present TS Cutter may be used to isolate a particular section for analysis.

MPEG-2, DVB and ATSC Tables

Only PIDs carrying MPEG-2 PSI tables are included in the System model. Any DVB or ATSC tables that are present in the Transport Stream are ignored.

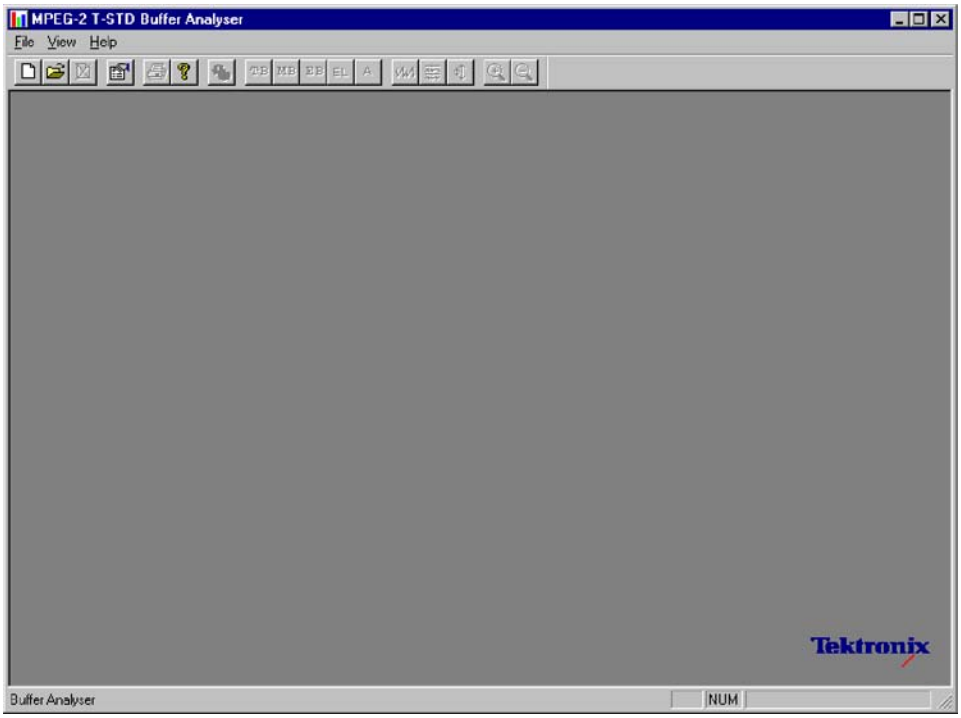
Starting the Program

The program may be started by selecting the Buffer Analyzer option from the Start > Programs menu or by double clicking on the Buffer Analyzer Shortcut on the desktop.



Initial Appearance

Once the program has started and is ready for use, it will open a Main Window. When the program starts, the main window looks like this:



The Toolbar (row of buttons above the dark gray area of the empty window) may be hidden from view, moved to a separate window, or moved to either side or the bottom of the main window.

The Status line at the very bottom of the window may be hidden from view. It displays information about the application and keyboard status.

Initial Menu Options

The application presents different menus and options, depending on whether a file is open for analysis. The menu options available when Buffer Analyzer has just been started, or after a file is closed, are:

File Menu Options. Table 4–1 lists the File menu options.

Table 4-1: File menu options

Command	Function
New	Opens a stream file for analysis and opens or creates a Buffer Model Results (BMR) file in which to store the results. The application opens a file selection dialog allowing the user to choose the stream file. It then opens another file selector dialog to specify the BMR file.
Open...	Opens an existing BMR file to review results of a previous analysis. The application opens the file selection dialog allowing the user to choose the required file.
Print Setup...	Opens a dialog for selecting which printer and associated options to use.
1 <filename> 2 <filename> 3 <filename> 4 <filename>	A list of the four most recently used BMR files. If Buffer Analyzer has recently been installed the list may hold less than four files. Selecting a filename opens that BMR file for review.
Exit	Finishes running the program.

View Menu Options. Table 4–2 lists the File menu options.

Table 4-2: View menu options

Command	Function
Toolbar	Displays or hides the toolbar.
Status Bar	Displays or hides the status bar.
Settings…	Opens the Settings dialog for specifying Video Buffer Sizes and Video Data Transfer method.

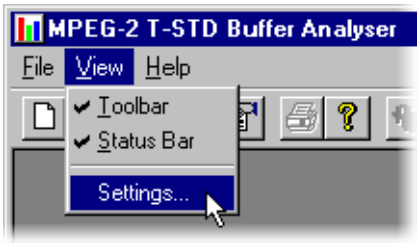
(a check mark next to an option shows that the toolbar is currently visible; no check mark means that it is hidden.)

Settings

Various configuration parameters, including Packet Interpretation, Pre-Scan Packets, PES Private Interpretation, Video Buffer Sizes, Video Data Transfer method, and Audio Buffer sizes may be modified before and after opening an MPEG file. When a file is open, one or more streams may be analyzed, the settings may be changed, and then other streams may be analyzed with the new settings. If the settings are changed, to reanalyze streams analyzed with previous settings, the MPEG file must be closed and opened again.

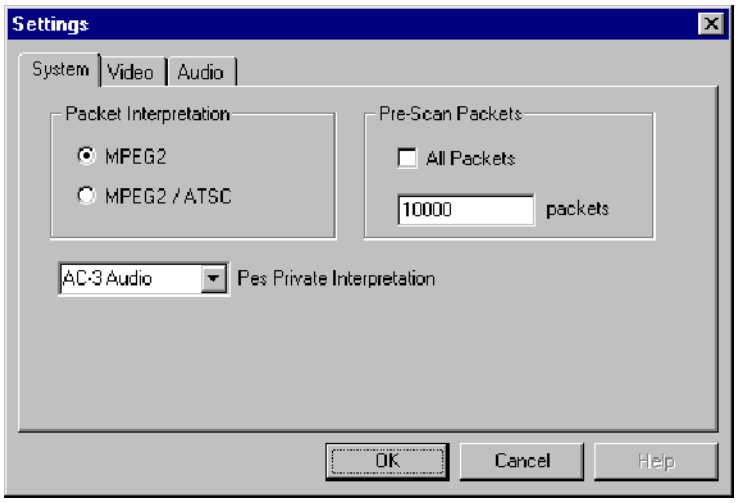
It is a good idea to check the settings before opening a file to verify the method with which video streams will be analyzed.

Select Settings... from the View menu to open the Settings dialog.



This opens the Settings dialog, which has three tabs: System, Video and Audio.

System Settings



These options can only be set before analyzing a file. They are disabled (grayed out) while a file is open.

The MPEG2 / ATSC option is available on ATSC or ATSC/DVB dual standard MPEG Test System products. It is disabled (grayed out) on single standard DVB systems.

Packet Interpretation. Specifies which standards will be used for interpreting the packets in the Transport Stream when a file is opened for analysis. The options are:

MPEG2 Interprets the packets according to the standards for DVB streams.

MPEG2 / ATSC — Interprets the packets according to the ATSC standards. This option is required to allow AC-3 audio stream content to be analyzed.

Pre-Scan Packets. During the initial processing of an MPEG file, a number of packets are prescanned for information that will result in a more accurate analysis of the initial parts of the transport stream. The greater the number of prescanned packets, the greater the chance of locating all of the information required for accurate analysis. The drawback is increased processing time. By default, 10000 packets are prescanned, which should be sufficient for most streams, excluding High Definition Video.

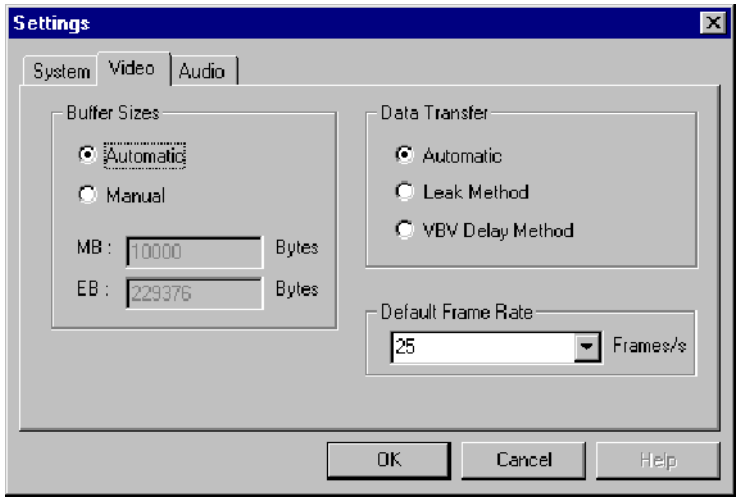
All Packets — Select this checkbox to cause all packets to be prescanned. If this checkbox is selected, the packets field will be disabled (grayed out).

Packets — If the All Packets checkbox is not selected, enter the number of packets to be prescanned in this field.

PES Private Interpretation. This setting specifies the model type to use for streams signaled as PES Private (stream_type = 6).

The selections available include the following: AC-3 Audio, AAC Audio, MPEG-2 Audio and Video and System. The default setting is AC-3 Audio.

Video Settings



Buffer Sizes. Specifies the sizes that will be used for the Main and Elementary Buffers, when interpreting the stream. The options are:

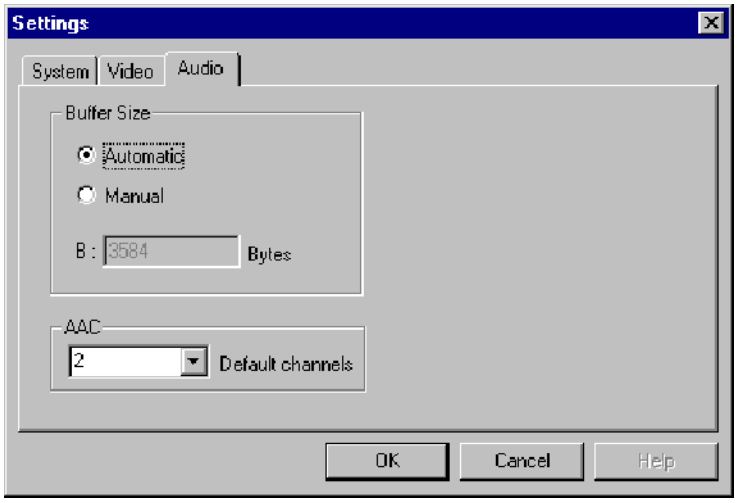
Automatic	Automatically detect the buffer sizes from the Sequence Headers and Extensions in the elementary stream being processed. This is the default option when the application is started.
Manual	Enables the size of the Main or Multiplex buffer (MB) and Elementary Buffer (EB) to be specified manually. The MB and EB fields are available for editing when this option is enabled.

Data Transfer. By default Buffer Analyzer inspects the stream to determine which transfer method to use. This can be overridden if required. The options are:

Automatic	Examine the stream to determine the transfer method. This is the default option when the application is started.
Leak Method	Forces modeling of the stream using the Leak Method.
VBV Delay Method	Forces modeling of the stream using the Video Buffer Verifier (VBV) Delay Method.

Default Frame Rate. The frame rate is one of the parameters that is searched for during the prescan phase of analysis. However if it is not found, then the default value selected from the drop-down list in the Default Frame Rate field is used.

Audio Settings



Buffer Size. Specifies the size that will be used for the audio buffer when interpreting the stream. The options are as follows:

Automatic	Automatically detect the buffer sizes from the Sequence Headers and Extensions in the elementary stream being processed. This is the default option when the application is started.
Manual	Enables the size of the buffer (B) to be specified manually. The B field is available for editing when this option is enabled.

AAC. Select the number of AAC channels required from the drop-down list.

Within the ADTS (Audio Data Transfer Stream) fixed header, the channel configuration field is used to indicate the number of channels required by AAC. If the number in this field is zero, then the value in the AAC Default channels field is used.

Note that the associated ADIF (Audio Data Interchange Format) is unsupported.

Refer to Information technology –
Generic coding of moving pictures and associated information,
Part 7: Advanced Audio Coding (AAC) ISO/IEC 13818-7:1997

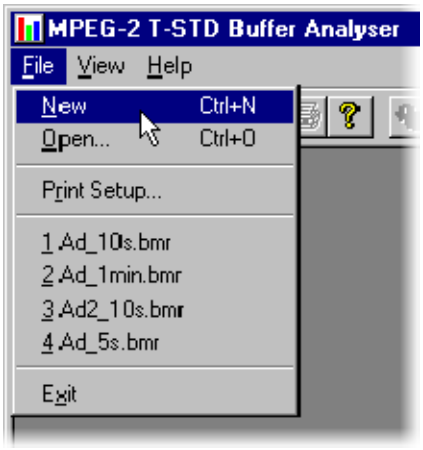
***NOTE**. Remember that if the settings are modified the new settings are used for all video streams which are subsequently processed. The settings are reset to the default option when the application is started.*

Opening an MPEG File

Any file holding a recorded or synthesized sample of a Transport Stream that carries video, audio, and/or system control streams canbe analyzed. These files are referred to as MPEG files to distinguish them from Buffer Model Results (BMR) files. The results of analysis are written to a BMR files.

Opening a File from the Menus and Toolbar

To open a file for analysis, select the New option from the File menu. Alternatively, use the Ctrl+N keyboard shortcut.



***NOTE**. The list of previously used files shows BMR not MPEG files, as can be seen by their .bmr extension.*

There is a shortcut button, for the New command, on the Toolbar:

In response to the New command, the Buffer Analyzer opens a file selection dialog to choose an MPEG file for processing. When the MPEG file has been chosen, the MPEG file selector closes and another file selection dialog opens. This is for choosing a Buffer Model Results File (BMR), which holds the results of any analysis performed on the MPEG file.

Buffer Analyzer suggests an output file with the same name as the MPEG file but a file extension of .bmr to hold the Buffer Model Results. Select OK to accept the suggested filename. Otherwise select a different file or type in a different name and then select OK.

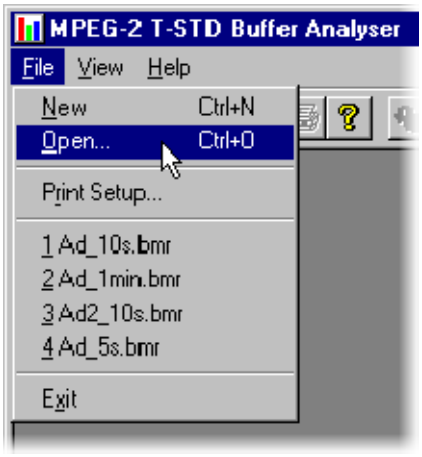
***NOTE**. Choosing an existing BMR file will erase all results that had previously been saved in that file.*

Opening a BMR File

An existing Buffer Model Results (BMR) file can be opened to review the results saved in it from previous Buffer Model Analysis.

Opening a File from the Menus and Toolbar

To open a BMR file select the Open... option from the File menu. Alternatively use the Ctrl+O keyboard shortcut.

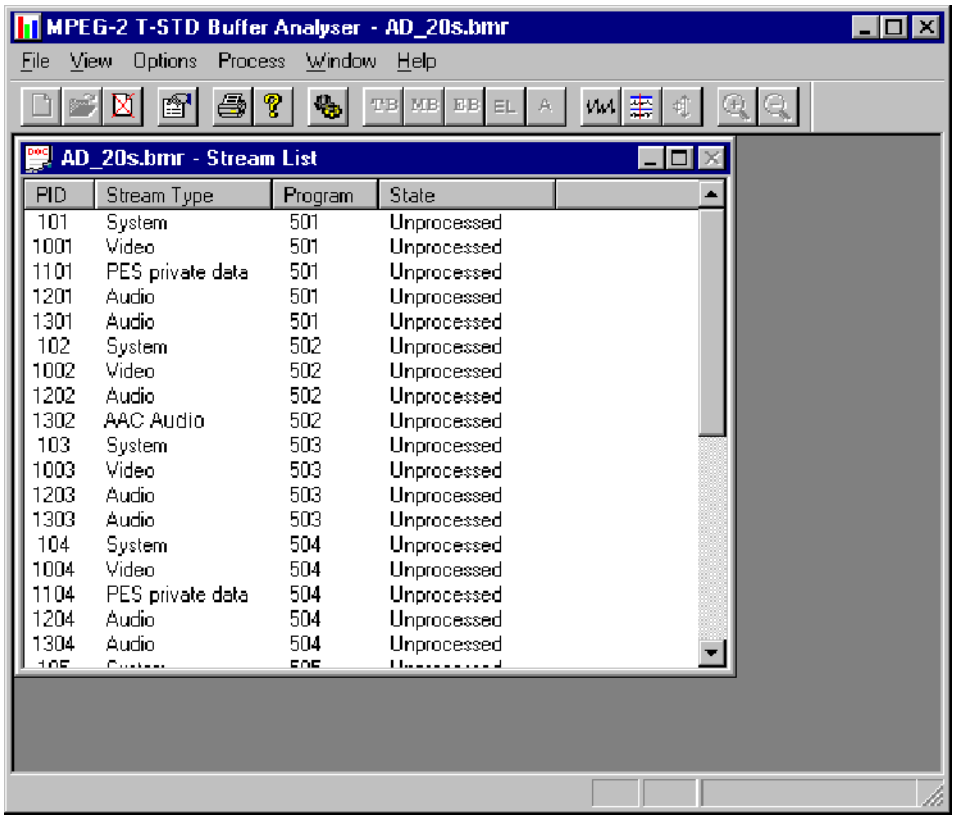


If the required file is in the list of recently analyzed BMR files, it can be opened from the list to save using the open file dialog.

There is a shortcut button available on the Toolbar for opening a file, which has the standard file open symbol:

Window Layout

The Stream List window is opened as soon as either an MPEG or BMR file is opened. The application inspects the file to find what program streams are present according to the Packet Interpretation setting. For example:


MPEG-2 T-STD Buffer Analyser - AD_20s.bmr
File View Options Process Window Help
AD_20s.bmr - Stream List
PID Stream Type Program State
101 System 501 Unprocessed
1001 Video 501 Unprocessed
1101 PES private data 501 Unprocessed
1201 Audio 501 Unprocessed
1301 Audio 501 Unprocessed
102 System 502 Unprocessed
1002 Video 502 Unprocessed
1202 Audio 502 Unprocessed
1302 AAC Audio 502 Unprocessed
103 System 503 Unprocessed
1003 Video 503 Unprocessed
1203 Audio 503 Unprocessed
1303 Audio 503 Unprocessed
104 System 504 Unprocessed
1004 Video 504 Unprocessed
1104 PES private data 504 Unprocessed
1204 Audio 504 Unprocessed
1304 Audio 504 Unprocessed

Initial Processing of MPEG Files

If an MPEG file is opened, the program performs initial analysis to form the Stream List and calculate the mean transport rate. All streams in the list are marked as Unprocessed, because no analysis has been performed on them in this session.

To build the Stream List the MPEG file is scanned for the PAT and PMT table contents. It is assumed that the contents are constant, which is the general case. If the program changes in a drastic way, such as streams disappearing between PMTs, the model will give meaningless results.

Only the first occurrence of complete PAT and PMT are read when forming the Stream List. Use TS Cutter to isolate a section when multiple versions of the tables occur.

A number of packets in the file are scanned for the Sequence Header and Extension start codes (containing profile and level) (see Settings, page 4–4). If they are not found the Main Profile and Level setting are assumed together with the maximum VBV buffer size.

Initial Processing of BMR Files

If a BMR file is opened, the State column indicates which streams had been processed. The file only holds results for those streams marked as Processed. To obtain results for unprocessed streams, the original MPEG file will have to be opened again and analyzed.

Menus and Controls

When a file is open, the program presents a different set of menus and options. They change as soon as the Stream List window appears. For example, the Open file commands are replaced by Close file commands.

Toolbar

The Toolbar provides a set of convenient shortcuts for the more frequently used menu options. The available commands are:

	Opens dialogs to select an MPEG file for analysis and a BMR file for saving the results. This button is disabled (grayed out) when a file is open.
	Opens a dialog to select a BMR file to review the results of a previous analysis session. This button is disabled (grayed out) when a file is open.
	Closes the current file. This button becomes available the moment a file is opened. If the wrong file is being opened, or the wrong options are selected, clicking on the button will abandon the analysis and close the file.
	Opens the Settings dialog.
	Prints the contents of the current window.
	Opens a dialog which displays the program version number.
	Analyzes the stream(s) from the PID(s) which are currently selected in the Stream List. This button is only enabled when one or more PIDs which are marked as unprocessed are selected.

The next group of five buttons open Results Views for the selected streams.

	Opens a graph of the Transport Buffer for the selected stream. This button is only enabled when the PID of a Processed stream is selected in the Stream List window.
	Opens a graph of the Multiplexing Buffer of a video stream; Main Buffer of an audio stream or of a system information stream. The button is only enabled when the PID of a Processed stream is selected in the Stream List.

EB	Opens a graph of the Elementary Stream Buffer for the selected video stream. This option is only available when a PID carrying a Processed Video stream is selected in the Stream List.
EL	Opens the Event Log for the selected stream. The button is only enabled when the PID of a Processed stream is selected in the Stream List window.
A	Opens all of the relevant graphs and the event log for the selected stream. This option is only available when a PID carrying a Processed Video stream is selected in the Stream List.

The remaining buttons control display options for Graphs of buffer analysis results.

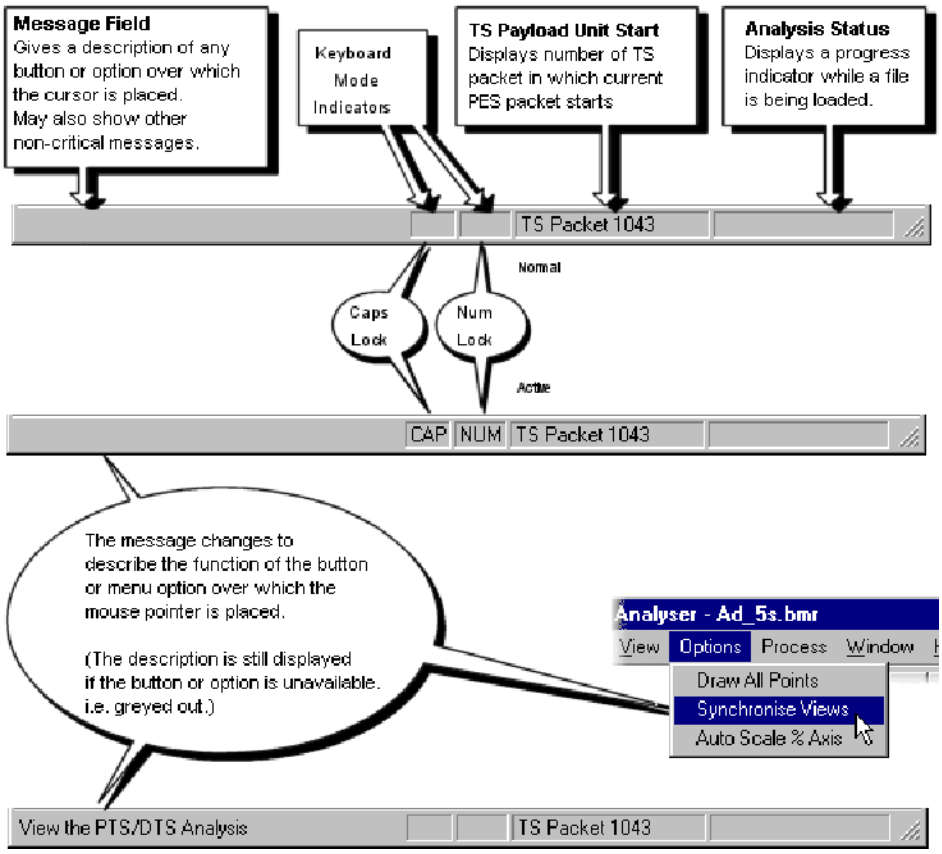
	Toggles the graph displays between having all points drawn and sampling the points for drawing.
	Synchronize Graphs toggles the graphs between using the same position and zoom settings or operating independently.
	Auto Scale toggles the selected graph between fixed and auto scaling of the y axis.
	Zoom In increases the magnification along the x-axis (time scale) of the currently selected graph. All graphs are affected if Synchronize Graphs is enabled.
	Zoom Out reduces the magnification along the x-axis (time scale) of the currently selected graph. All graphs are affected if Synchronize Graphs is enabled.

The Toolbar can be dragged off the edge of the main window into a floating pallet. To do this, place the mouse pointer on the background inside the Toolbar, (not on one of the buttons), hold the left button down, and drag into the main window area. The result is a self-contained window that looks like this:

To replace the Toolbar on the window border drag it over the border, until the outline changes shape, and release it. It can be placed on the top, bottom, left or right hand edges.

Status Bar

The Status Bar may be hidden from view, but if is visible, it is always at the bottom of the main window. It displays the following information about the program and keyboard states:


Message Field
Gives a description of any button or option over which the cursor is placed. May also show other non-critical messages.
Keyboard Mode Indicators
TS Payload Unit Start
Displays number of TS packet in which current PES packet starts
Analysis Status
Displays a progress indicator while a file is being loaded.
TS Packet 1043
Normal
Caps Lock
Num Lock
Active
CAP
NUM
TS Packet 1043
The message changes to describe the function of the button or menu option over which the mouse pointer is placed.
(The description is still displayed if the button or option is unavailable. i.e. greyed out.)
Analyser - Ad_5s.bmr
View
Options
Process
Window
Draw All Points
Synchronise Views
Auto Scale % Axis
View the PTS/DTS Analysis
TS Packet 1043

Menu Options

Table 4–3 to Table 4–8 list the available menu options.

Table 4-3: File menu options

Command	Function
Close	Closes the current file. This option is available as soon as analysis starts. If the wrong file is being opened, or the wrong options are selected, selecting this option will abandon the analysis and close the file.
Print	Prints contents of the current window.
Print Preview	Prints contents of the current window.
Print Setup	Selects printer and configuration.
Exit	Closes any file that is open and terminates the program.

Table 4-4: View menu options

Command	Function
Toolbar	Shows or hides the Toolbar.
Status Bar	Shows or hides the Status Bar.
Settings…	Opens the Settings dialog.
Global Event Log	Shows or hides the Global Event Log window.
Transport Buffer	Opens a graph of the Transport Buffer for the selected PID.
Main Buffer	Opens a graph for the selected PID in the Stream List. The graph shows results for the Main Buffer of audio and system streams or the Multiplex Buffer for video streams.
Elementary Buffer	Opens a graph of the Elementary Buffer for the selected PID.
PID Event Log	Displays the Event Log for the selected PID.
All Buffers	Opens all graphs and the log for the selected PID.

Table 4-5: Options menu options

Command	Function
Draw All Points	Toggles between drawing all points on the graphs, drawing every nth point. 'n' is calculated from the total number of data points and the screen space for the graph.
Synchronize Views	Toggles the graphs between using the same position and zoom settings and operating independently.
Auto Scale % Axis	Toggles the selected graph between fixed and auto scaling of the y axis.

Table 4-6: Process menu options

Command	Function
Process Streams	Applies the stream(s) from the PID(s) selected in the Stream List to the System Target Decoder Buffer Model. This option is only enabled when one or more unprocessed PIDs are selected in the Stream List.

Table 4-7: Window menu options

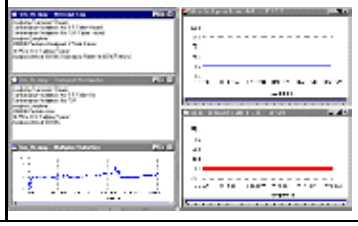
Command	Function
Cascade Cascade	Arranges the windows like this:
Tile Tile	Tiles the windows. For example, five windows would be tiled like this: 

Table 4-7: Window menu options (Cont.)

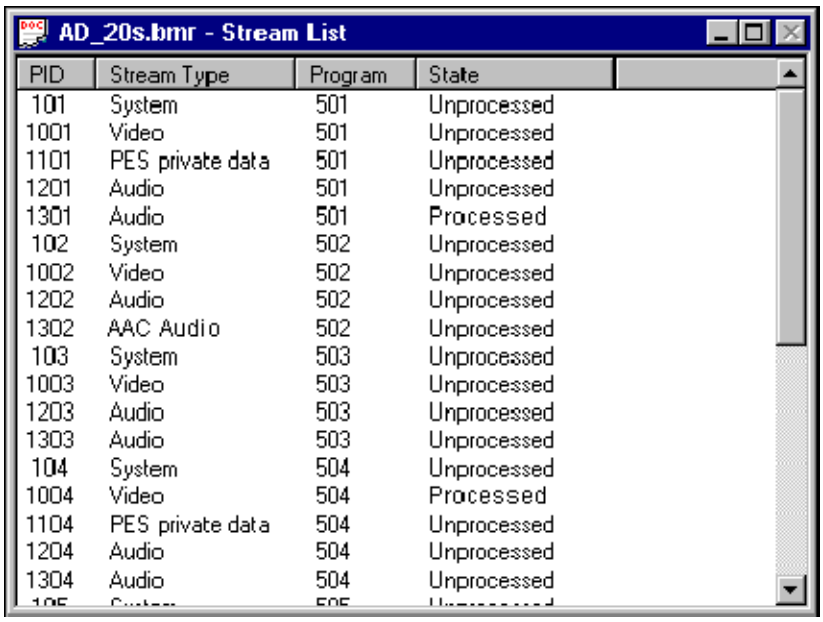
Command	Function
Arrange Icons	Arranges any minimized windows along the bottom of the main window. Aligns icons of any minimized windows at the bottom of the program's main window.
1 <window title>	Lists all of the available windows. A check mark indicates the active window. Select an option to bring that window to the top.

Table 4-8: Help menu options

Command	Function
About Buffer Analyzer…	Opens a dialog that displays the program version number.

Stream List

The Stream List displays all of the elementary streams in the file. The streams are sorted and grouped together by Program number. Within each program, the streams are sorted in ascending PID number.

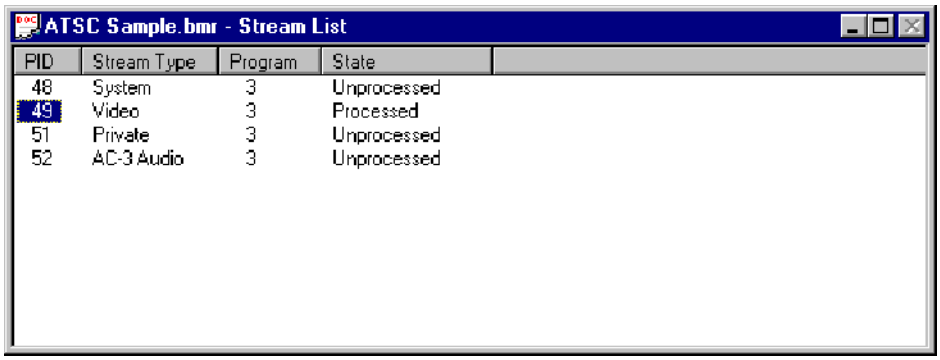


PID	Stream Type	Program	State
101	System	501	Unprocessed
1001	Video	501	Unprocessed
1101	PES private data	501	Unprocessed
1201	Audio	501	Unprocessed
1301	Audio	501	Processed
102	System	502	Unprocessed
1002	Video	502	Unprocessed
1202	Audio	502	Unprocessed
1302	AAC Audio	502	Unprocessed
103	System	503	Unprocessed
1003	Video	503	Unprocessed
1203	Audio	503	Unprocessed
1303	Audio	503	Unprocessed
104	System	504	Unprocessed
1004	Video	504	Processed
1104	PES private data	504	Unprocessed
1204	Audio	504	Unprocessed
1304	Audio	504	Unprocessed

Stream Type indicates whether the stream is Video, Audio, AC-3 Audio, AAC Audio, System or Private. Private streams cannot be processed, but may show more information in the type, for example ISO/IEC 13818 Auxiliary. The Packet Interpretation from the System tab of the Settings dialog sets which standard is used for identifying these types.

The preceding example is from a DVB compliant transport stream.

An ATSC stream might look like this:



State indicates if the stream has been processed (analyzed in the buffer model). A stream may only be processed once while the file is open. To process a stream again, the file must be closed and then opened again.

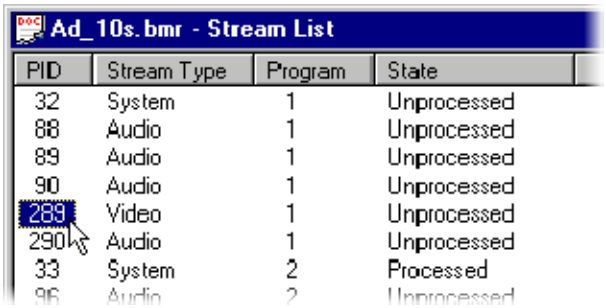
When an MPEG file is first opened, the program streams are all marked as Unprocessed. This is because no buffer model analysis has yet been performed in this session.

If a BMR file is opened, the State column indicates which streams have been processed. The file only holds results for those streams marked as Processed. To obtain results for Unprocessed streams the original MPEG file will have to be opened and analyzed.

Selecting Streams

To analyze or open the results views for a stream, or streams, they must first be selected in the Stream List. To select a stream, click on the PID number.

For example, to select the Video stream carried in PID 289, click on the number 289.



To select a contiguous range of streams: click on the first streams PID, then hold the Shift or ▲ key down and click on the last stream's PID number. If the required streams are not adjacent, hold the Ctrl key down and click on the PID number for each stream.

All streams can be deselected by double-clicking the mouse pointer over any item of data other than in the PID column. To deselect a particular stream while leaving others selected, hold the Ctrl key down and click on the stream's PID number.

Processing Streams

Having selected one or more streams from the Stream List they can be analyzed in the buffer model.

To start analysis, select the Process Streams option from the Process menu.

Alternatively, click on the Process button in the toolbar.

Supported Profiles & Levels

Buffer Analyzer supports the 6 Profiles: Simple, Main, SNR, Spatial, High and 4:2:2.

It supports the 4 Levels: High, High - 1440, Main and low.

Details of valid combinations of profile and level are given in standards document ISO/IEC 13818 part 2 section 8.5.

Start-Up

The hypothetical T-STD specified in ISO/IEC 13818 part 1 section 2.4.2 assumes a processing steady state. To handle the start-up processing before reaching the steady state Buffer Analyzer performs as follows:

- The fraction of the first video frame leading up to the first picture start code is not passed through the Buffer Analyzer. This is because it is not possible to determine whether the Leak or VBV Delay method is being used. During this period, the PES header, Sequence Header, and Extension information are extracted. This information is used to determine the initial DTS, size of the MB and EB buffers.
- The Decoding Time Stamp (DTS) for the first frame is assumed to be correct. It is used as a base for the timing of all subsequent frames. MB underflow errors are suppressed during the first frame.

If the DTS of the first frame is not correct, use TS Cutter to remove the suspect frame(s) from the file.

Approximations

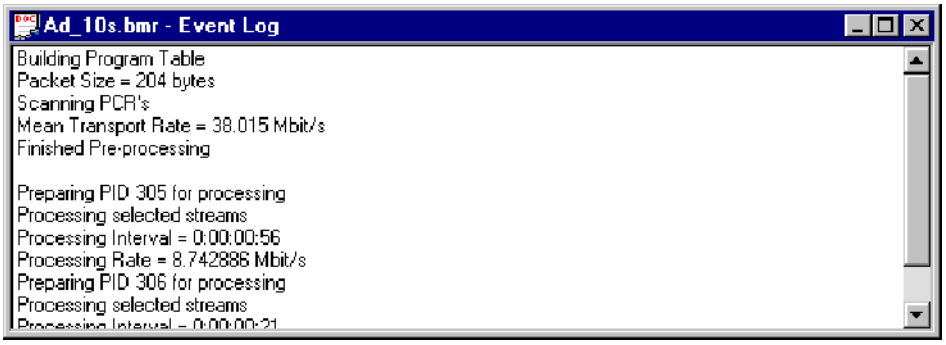
The application uses the following approximations to model the behavior of the hypothetical T-STD:

- Data is processed one packet (188 bytes) at a time. An underflow/overflow condition that occurs and clears within the period of one packet will be missed.
- Processing one packet at a time causes the buffers to be emptied in block fashion, thus giving a stepped graphical output.
- Slight quantization effects occur because the model is processed at discrete time intervals, corresponding to a single packet length. This may affect the VBV Delay calculations. The timing intervals for transferring frames from MB to EB are dynamically adjusted to compensate.

Event and Message Logs

The T-STD Buffer Analyzer allows you access to the Global Event log and the PID Event log. You can also configure the T-STD Buffer Analyzer to work with the Tracer utility to create a log containing more analysis detail.

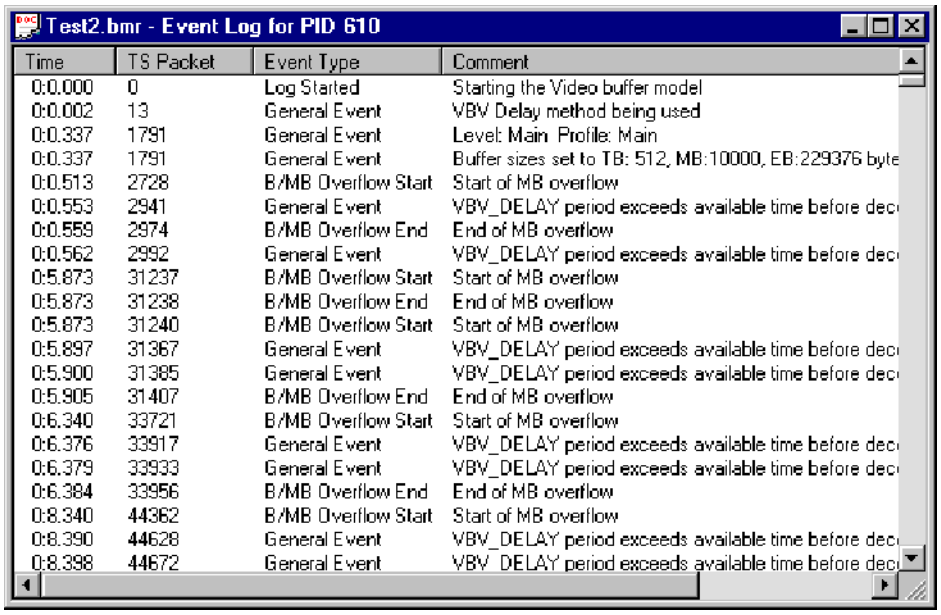
Global Event Log



The Global Event Log displays: reports from the initial analysis, PID independent information (Transport Stream errors) and high level details for each stream processed.

For details of events detected during the processing of a stream, open the PID Event Log for that stream.

PID Event Log



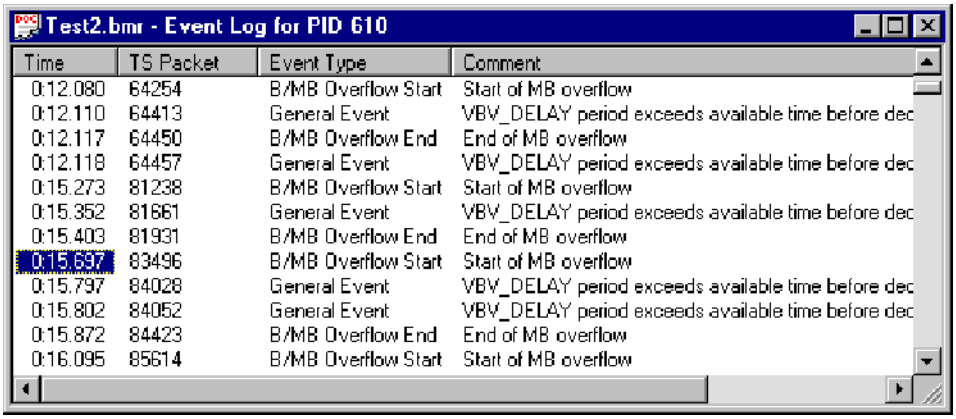
Time	TS Packet	Event Type	Comment
0:0.000	0	Log Started	Starting the Video buffer model
0:0.002	13	General Event	VBV Delay method being used
0:0.337	1791	General Event	Level: Main Profile: Main
0:0.337	1791	General Event	Buffer sizes set to TB: 512, MB:10000, EB:229376 byte
0:0.513	2728	B/MB Overflow Start	Start of MB overflow
0:0.553	2941	General Event	VBV_DELAY period exceeds available time before dec
0:0.559	2974	B/MB Overflow End	End of MB overflow
0:0.562	2992	General Event	VBV_DELAY period exceeds available time before dec
0:5.873	31237	B/MB Overflow Start	Start of MB overflow
0:5.873	31238	B/MB Overflow End	End of MB overflow
0:5.873	31240	B/MB Overflow Start	Start of MB overflow
0:5.897	31367	General Event	VBV_DELAY period exceeds available time before dec
0:5.900	31385	General Event	VBV_DELAY period exceeds available time before dec
0:5.905	31407	B/MB Overflow End	End of MB overflow
0:6.340	33721	B/MB Overflow Start	Start of MB overflow
0:6.376	33917	General Event	VBV_DELAY period exceeds available time before dec
0:6.379	33933	General Event	VBV_DELAY period exceeds available time before dec
0:6.384	33956	B/MB Overflow End	End of MB overflow
0:8.340	44362	B/MB Overflow Start	Start of MB overflow
0:8.390	44628	General Event	VBV_DELAY period exceeds available time before dec
0:8.398	44672	General Event	VBV_DELAY period exceeds available time before dec

An Event Log window may be opened for each PID that has been or is currently being processed. Results are written to the log as they are produced.

All times and packet numbers are given relative to the start of the file.

Event Selection

Selecting the time of an event from the Event Log will place a cursor at that time in each of the Buffer results Graphs. To select an event, click on its Time in the left column. For example, to select the B/MB Overflow Start for packet 83496, click on the time 0:15.697.


Test2.bmr - Event Log for PID 610
Time
TS Packet
Event Type
Comment
0:12.080 64254 B/MB Overflow Start Start of MB overflow
0:12.110 64413 General Event VBV_DELAY period exceeds available time before dec
0:12.117 64450 B/MB Overflow End End of MB overflow
0:12.118 64457 General Event VBV_DELAY period exceeds available time before dec
0:15.273 81238 B/MB Overflow Start Start of MB overflow
0:15.352 81661 General Event VBV_DELAY period exceeds available time before dec
0:15.403 81931 B/MB Overflow End End of MB overflow
0:15.697 83496 B/MB Overflow Start Start of MB overflow
0:15.797 84028 General Event VBV_DELAY period exceeds available time before dec
0:15.802 84052 General Event VBV_DELAY period exceeds available time before dec
0:15.872 84423 B/MB Overflow End End of MB overflow
0:16.095 85614 B/MB Overflow Start Start of MB overflow

To deselect an event, click the mouse pointer over any part of the data, other than in the Time column. Alternatively, hold the Ctrl key down and click on the selected event Time.

Detail Message Logging

The Buffer Analyzer may be used with the software developers utility Tracer to reveal more detail. When executed with the -d command line option, the Buffer Analyzer produces a detail message log, which may be read with the Tracer program.

These messages may be useful for in-depth analysis of the internal processing, particularly for the video stream type. Tracer has filtering capabilities that allow the user to focus on message types of particular interest. Detail messages generated by Buffer Analyzer while Tracer is not running may be lost.

Refer to *Tracer* (section 11) for details of how to set up and use Buffer Analyzer and Tracer together.

Results Graphs

The results of the analysis are plotted on a separate graph for each buffer. When a graph is opened for a stream that is still being processed, each result is plotted as soon as it is produced from the model.

All of the graphs have a similar format and controls.

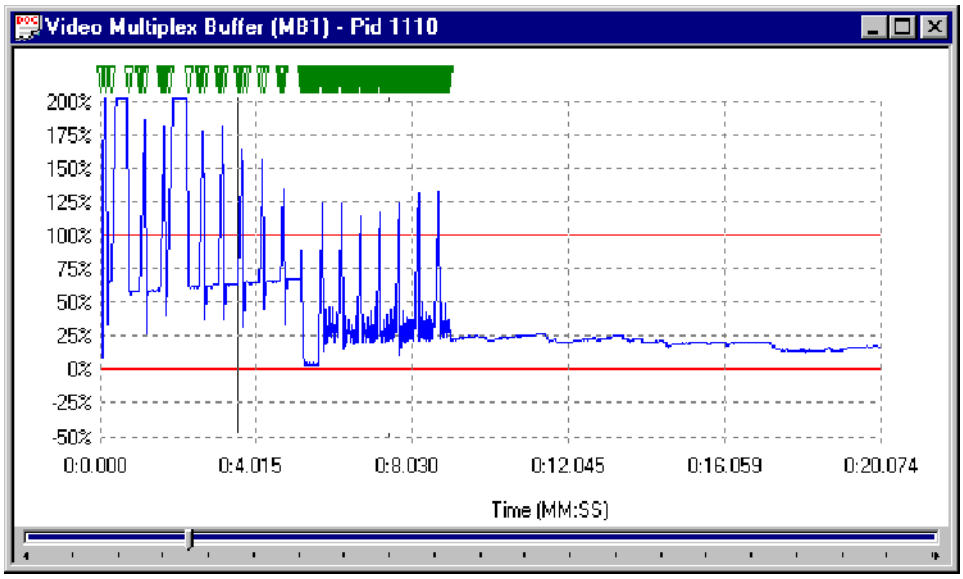
Common Features

The Axes

All of the graphs plot time from the start of file on the x-axis and current space used in the buffer on the y-axis.

Zoom

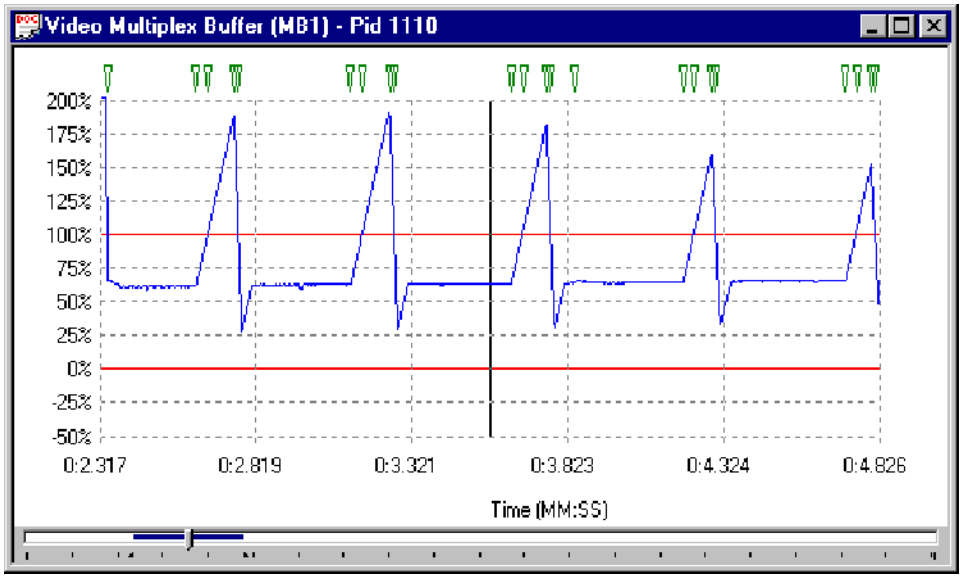
When the results graph is first opened, the entire graph is shown. Even a small file may display data points packed too closely to see the features clearly. For example, here is just under 20 seconds of a video stream that generated a lot of events:



Even this small sample holds some solid bands of blue lines and green event markers, from which only general trends can be determined. To change the time scale (x-axis) to resolve finer detail, click on the Zoom In button on the Toolbar:

Zoom in as many times as required to achieve the desired magnification. The magnification is doubled each time the button is clicked.

In this example, clicking on the Zoom In button three times gave a much clearer view:

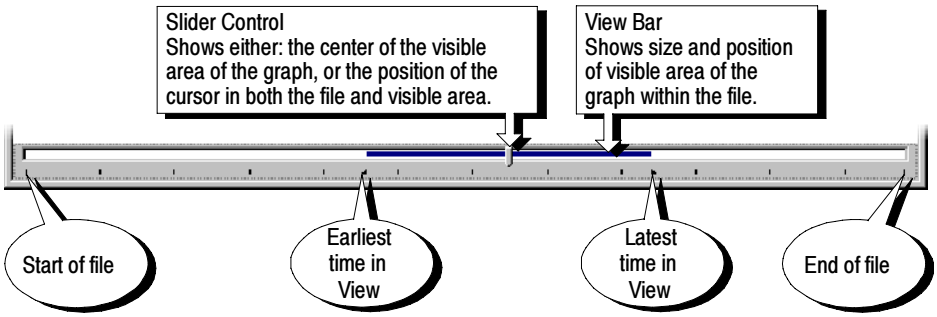


To Zoom back out, click on the Zoom Out button as many times as required:

Each time the Zoom Out button is clicked, the magnification is halved, until the full graph is again displayed.

Scrolling the View

The slider at the bottom of the window indicates where the displayed area is in relation to the rest of the file. It can be used to scroll the display through the graph in a similar way to a window scroll bar.


Slider Control
Shows either: the center of the visible area of the graph, or the position of the cursor in both the file and visible area.
View Bar
Shows size and position of visible area of the graph within the file.
Start of file
Earliest time in View
Latest time in View
End of file

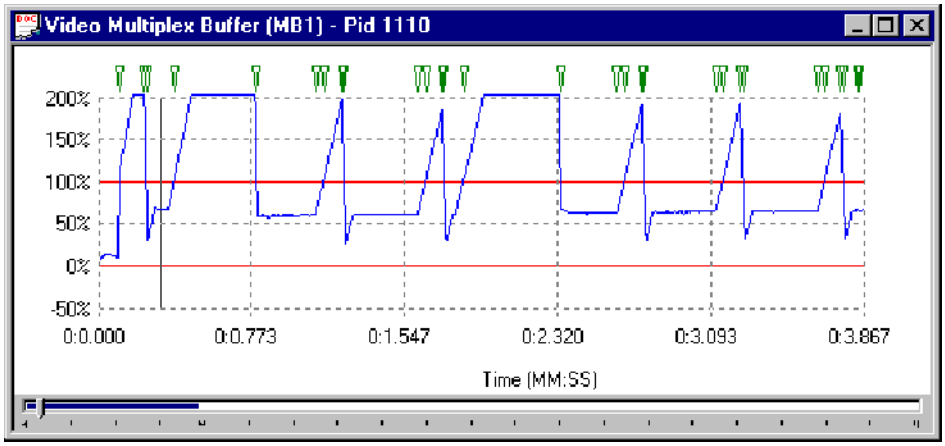
To scroll the stream through the view:

- Drag the Slider Control left or right with the mouse.
- Click the mouse pointer in the slider bar (either the clear sections or the view bar) to the side of the Slider Control.

When a time or event is selected on the graph, the Slider Control is automatically repositioned within the View Bar. The placement of the Slider Control reflects the position of the selected packet in the field of view.

Event Markers

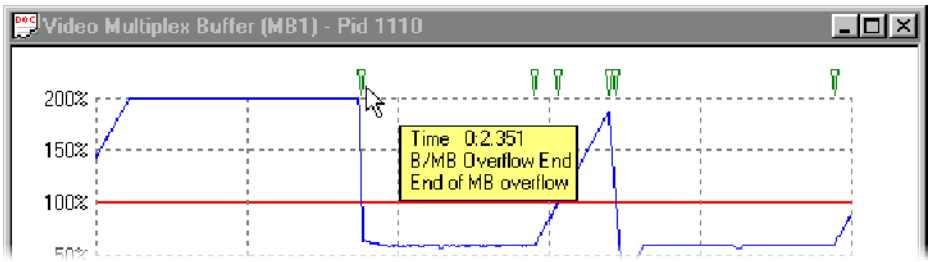
A graph may show one or more green triangular markers along the top. Each marker indicates the time a particular event, listed in the PID Event Log, occurred.



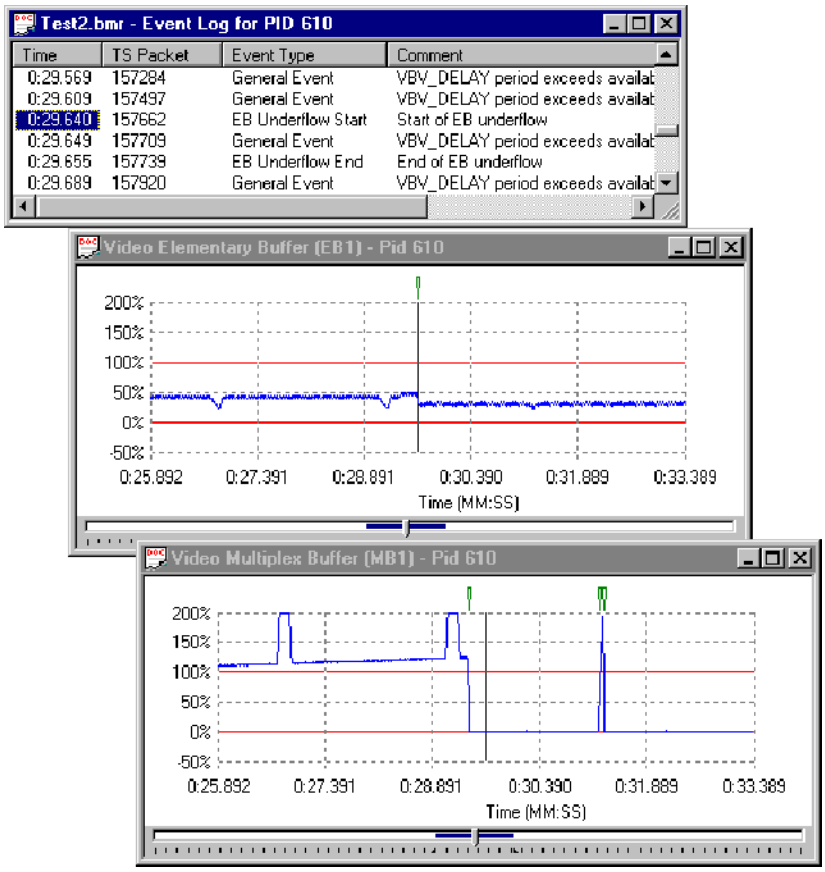
Only events that relate to the points plotted on the graph are displayed in that graph. Hence an event relating to a Video Multiplex Buffer will only be marked

on the Video Multiplex graph and not on the Elementary or Transport Buffer graphs.

Double-clicking on a marker will display a pop-up window. This shows the time and a brief description of the event that is marked.

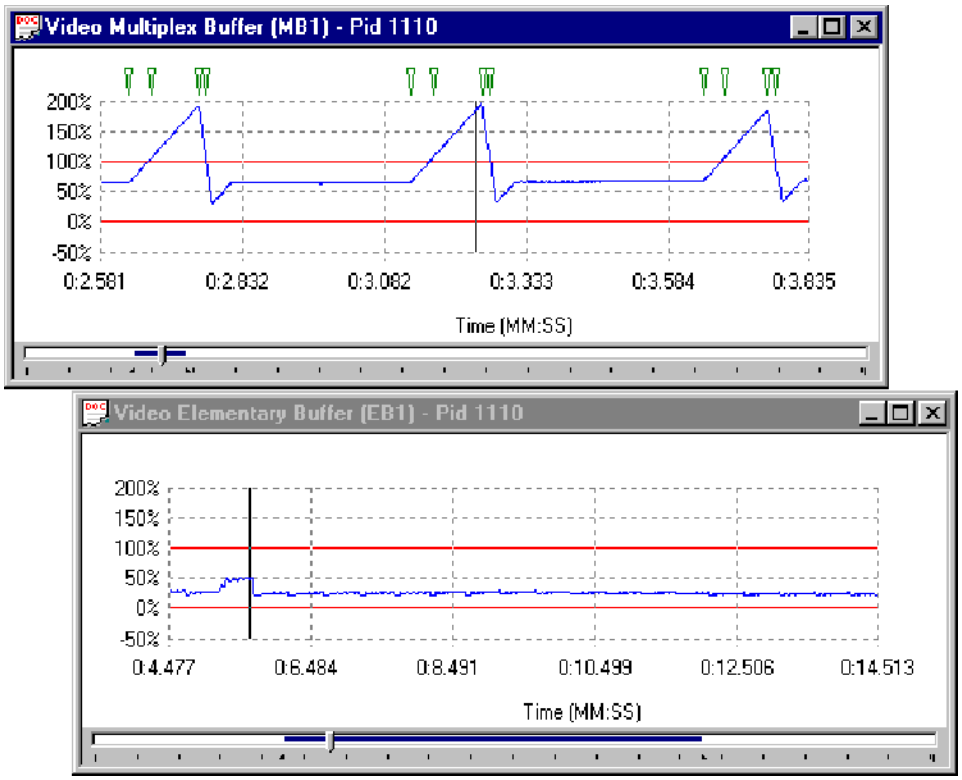


For example: selecting an event relating to the Elementary Buffer from the Event Log of a video stream will place a cursor at the time of the event in the buffer results graphs. Looking at the graphs, a marker of the event has been placed on the Elementary Buffer graph, but not the Multiplex Buffer graph.


Test2.bmr - Event Log for PID 610
Time
TS Packet
Event Type
Comment
0:29.569 157284 General Event VBV_DELAY period exceeds availat
0:29.609 157497 General Event VBV_DELAY period exceeds availat
0:29.640 157662 EB Underflow Start Start of EB underflow
0:29.649 157709 General Event VBV_DELAY period exceeds availat
0:29.655 157739 EB Underflow End End of EB underflow
0:29.689 157920 General Event VBV_DELAY period exceeds availat
Video Elementary Buffer (EB1) - Pid 610
200%
150%
100%
50%
0%
-50%
0:25.892
0:27.391
0:28.891
0:30.390
0:31.889
0:33.389
Time (MM:SS)
Video Multiplex Buffer (MB1) - Pid 610
200%
150%
100%
50%
0%
-50%
0:25.892
0:27.391
0:28.891
0:30.390
0:31.889
0:33.389
Time (MM:SS)

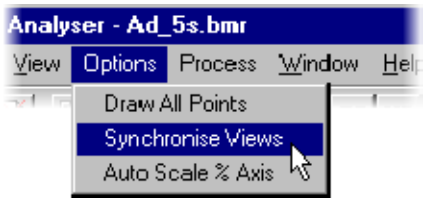
Synchronize Views

Graphs of results may be open for one or more streams. For each stream, one or more graphs may be displayed. The graphs may have their zoom, cursor position and visible section manipulated separately or all the graphs may be synchronized. For example, in unsynchronized operation, the open graphs may look like this:



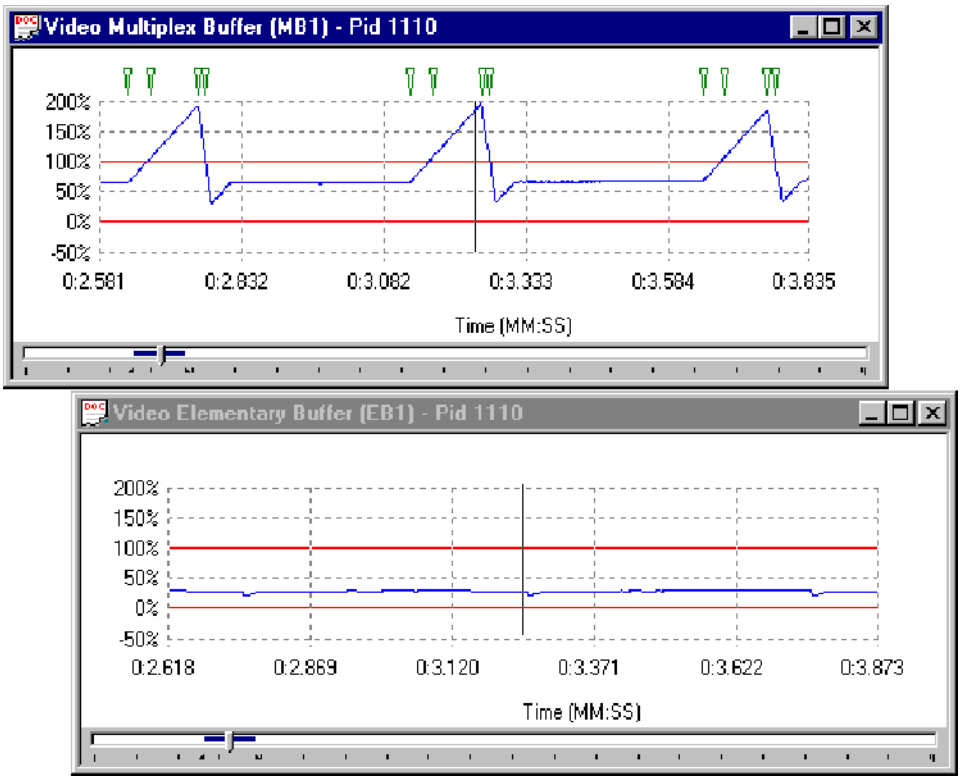
This pair of graphs show different periods in the file at different magnifications.

To synchronize the views, select the Synchronize Views option from the Options menu.



Alternatively, click on the equivalent shortcut button.

This will apply the zoom, cursor, and visible section of the active window to all of the other graphs. While Synchronize Views is enabled a change to any graph is immediately applied to all of the other graphs. After selecting Synchronize Views, the previous example looked like this:



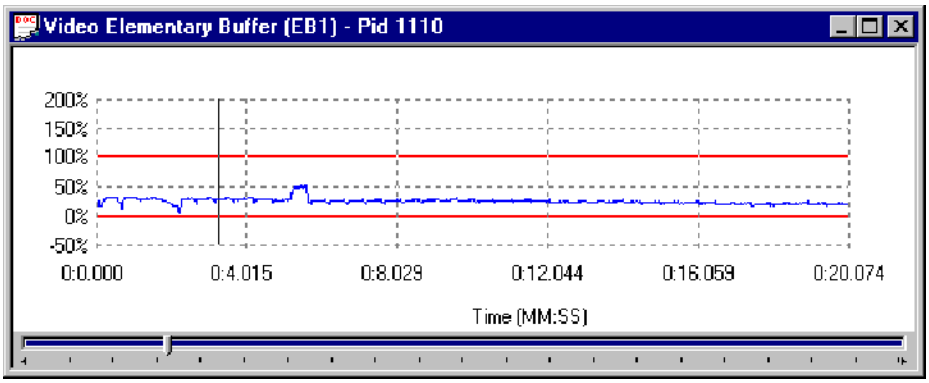
To separate the control of the graphs, disable synchronize views by selecting the menu option or clicking on the shortcut button again.

Selection

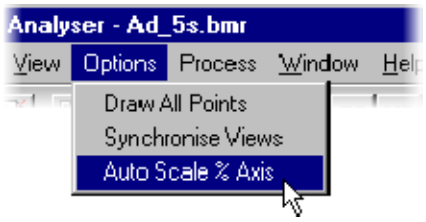
The cursor may be repositioned within a graph by clicking on the required point. This is useful when Synchronize Views is selected as a way of marking the same time in all the graphs for ease of comparison.

Auto Scale

The scale on the y-axis of the graphs shows space used in the buffer as a percentage. By default, all of the graphs have a vertical scale that goes from -50% to 200%. For example:

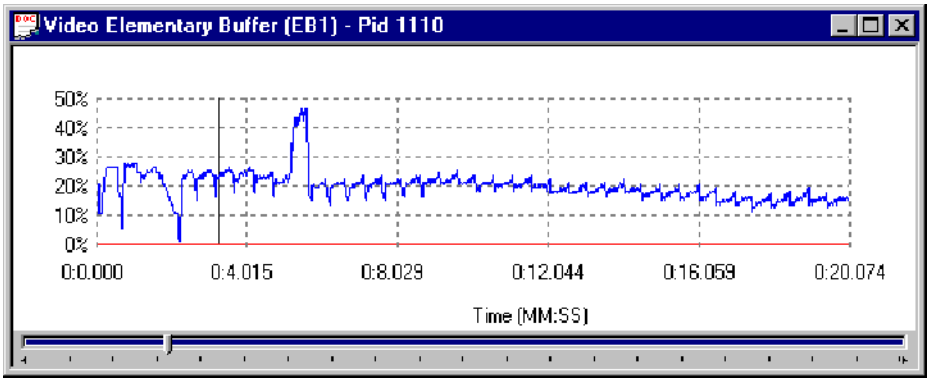


Selecting the Auto Scale % Axis option from the Options menu changes the y-axis for the currently active graph.



Alternatively, select the equivalent shortcut button.

The y-axis is now drawn so that the full scale contains the range of values in the graph, to the nearest 25%. For example, if the range of values was from 30% to 64%, the y-axis would go from 25% to 75%. The earlier example will be rescaled to look like this:



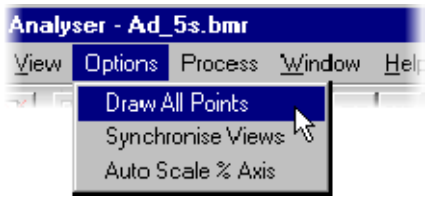
To revert to the default scale, select the menu option or click on the shortcut button again.

Draw All Points

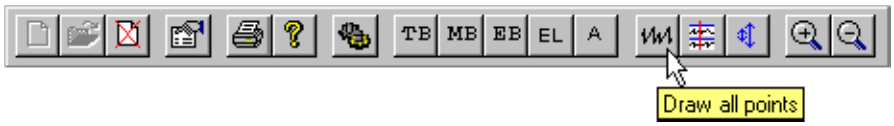
The graphs will often contain more data points than can be resolved on the screen. By default, to avoid drawing points on top of each other, the application will plot every nth point. This also speeds up drawing process. How many points to plot is determined from the available width of the graph on the screen and the total number of points to plot.

Use the Draw All Points option to look for outlying points and to resolve the fine detail when zoomed in on the data.

Selecting the Draw All Points option from the Option menu will cause the application to plot every point.

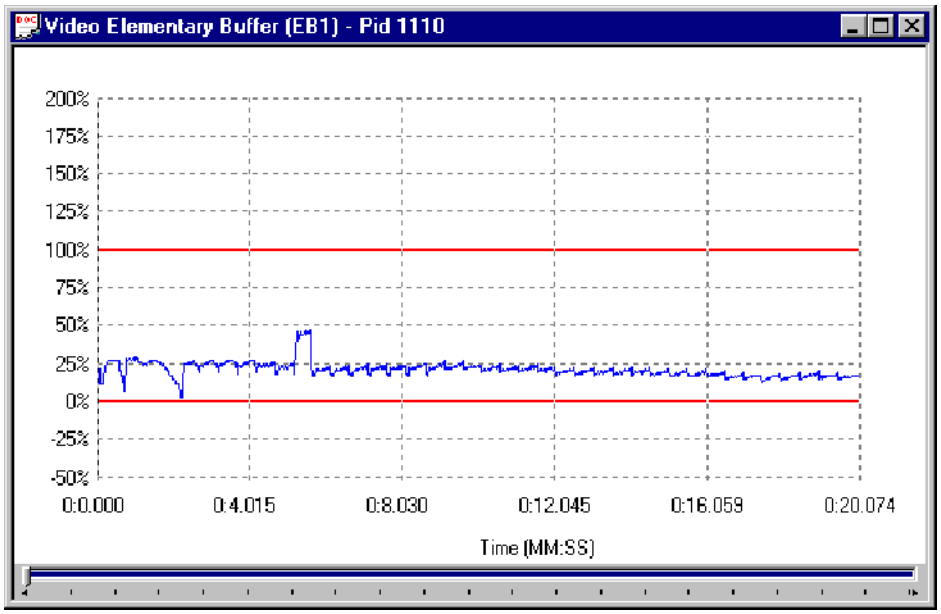


Alternatively, select the equivalent shortcut button.



This may take much longer for larger files than the default option. The option may be disabled by clicking on the shortcut button again or deselecting the option from the menu. This can be done even while still redrawing the graphs.

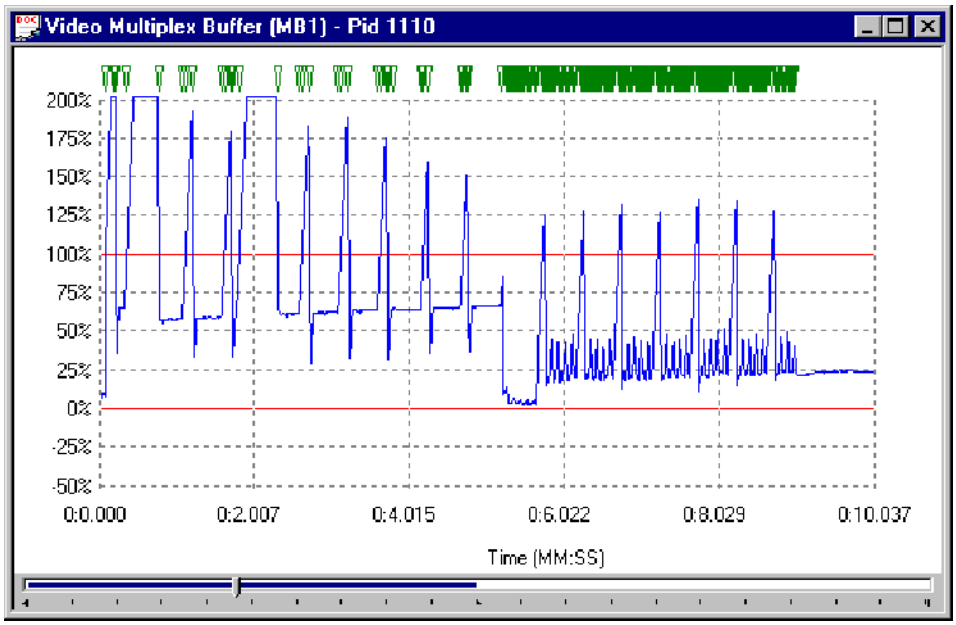
Elementary Buffer Graph



An Elementary Buffer graph can only be opened for Video Streams, since these are the only type that have an elementary buffer.

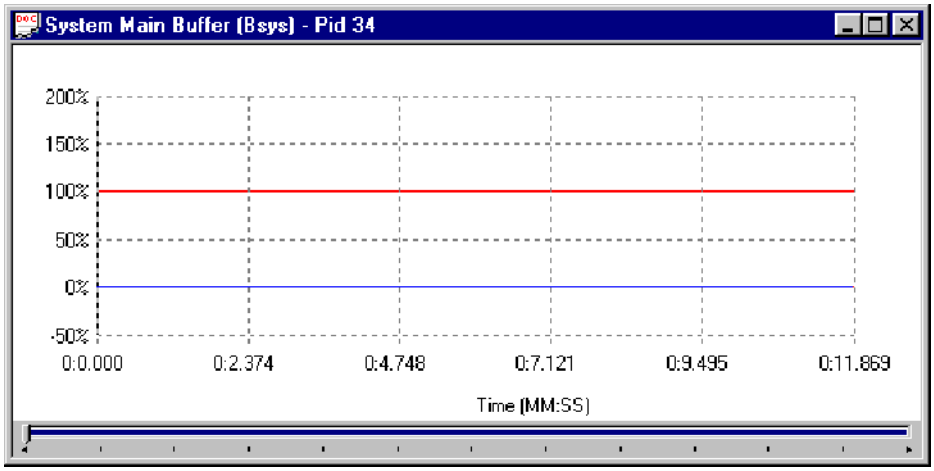
Elementary Buffers are not allowed to overflow, so the graph of the results never goes above 100%. The graph uses the scale -50% to +250% to make comparison easy.

Multiplex or Main Buffer Graph

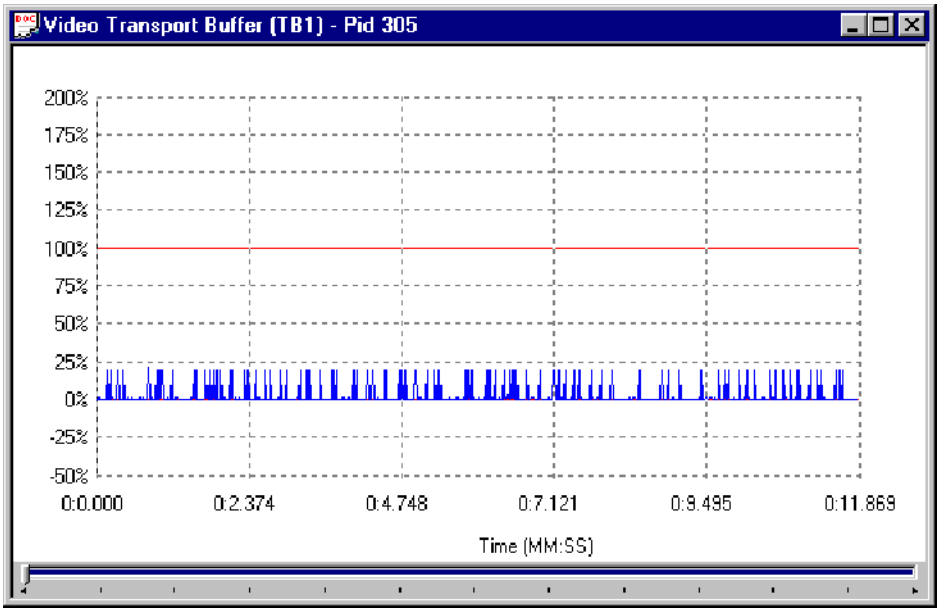


For Video streams this graph shows the results for modeling a Multiplex Buffer. For Audio and System Control streams the graph shows the results for the Main buffer. The title bar shows the stream type.

Here is an example to show the title for a graph of a System Control stream, on PID 34, taken from a different file:

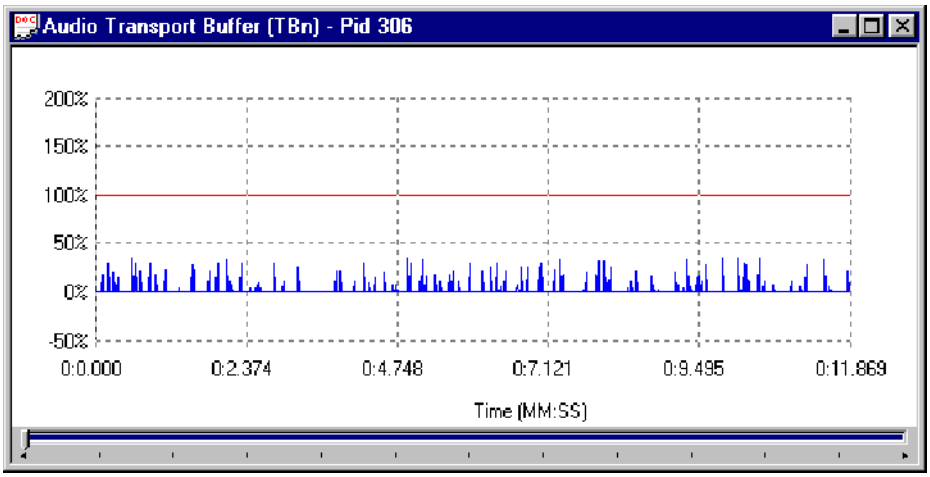


Transport Buffer Graph



The Transport Buffer graph shows results of modeling the Transport Buffer for Video, Audio, or System Control streams. The type of stream is shown in the title bar. In the above example, the results plotted are for a Video stream carried in PID 305.

Here is an example of an audio stream, on PID 306, from the same transport stream:



Detail Message Logging

The Buffer Analyzer may be used with the software developers utility Tracer to reveal more detail. When executed with the -d command line option, the Buffer Analyzer produces a detail message log, which may be read with the Tracer program.

These messages may be useful for in-depth analysis of the internal processing, particularly for the video stream type. Tracer has filtering capabilities that allow the user to focus on message types of particular interest. Detail messages generated by Buffer Analyzer while Tracer is not running may be lost.

Refer to the separate sub-section on Tracer, for details of how to set up and use Buffer Analyzer and Tracer together.

Elementary Stream Analyzer

Getting Started

Elementary Stream (ES) Analyzer is an MPEG (Motion Pictures Expert Group) stream analyzer that allows all MPEG-1 and MPEG-2 streams to be quickly analyzed. Developers of MPEG compliant encoder and decoder systems, or field application engineers (FAEs) supporting MPEG-based products will find ES Analyzer a powerful and easy-to-use tool and debugging aid.

ES Analyzer provides the following facilities:

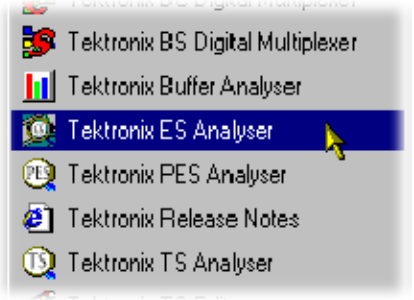
- Analyze in detail and verify whether MPEG-1 system and MPEG-2, video, and audio streams conform to MPEG standards. (A built-in stream demultiplexer makes it possible to analyze elementary streams embedded in a transport stream. All streams are checked for both syntactic and semantic conformance. Syntactic conformance means conformance with the MPEG language, while semantic conformance relates to the field value and range restrictions.)
- Quickly zoom from transport streams, through PES and video streams into GOP, pictures, slices, and all the way down to the macroblock layer.
- Play out audio streams to MPEG-1, MPEG-2, Layers I and II, Japanese AAC, and Dolby Digital (AC-3) standards.
- Audio play to soundcard.
- Analyze Layer I, Layer II audio data, AC-3 audio, and AAC audio.
- View video output with the incorporated video player and analyze picture data for any frame.
- Produce picture quality analysis data including Quantizer Scale distribution, motion vectors graph in a picture, and macroblock and picture size plots.
- View the coded block patterns that have been extracted.
- Display and analysis of DCT coefficients for each macroblock in a picture.
- View interpreted and hexadecimal view of headers for all streams.
- Display and analysis of DVB Teletext information.
- View and analyze DVB subtitle content.
- View and analyze ATSC closed caption to EIA608 and EIA708 standard.
- View PID spectrum analysis for transport streams.
- Analyze multiple streams in batch mode through the regression testing mode.

- Quickly navigate through stream hierarchy using the powerful and easy to use graphical interface including the Stream Properties summary window.
- 'Seekback' at all levels, allowing users to go back in a stream at all levels, thus allow more flexibility in navigation.
- Set a level to report errors, filter them, and also store errors in log files.

***NOTE**. It is assumed that you are familiar with MPEG compression standards and terminology. If you are new to MPEG and want to know about MPEG compression standards and terminology, refer to the documents: ISO/IEC 11172 (Vol. 1, 2, 3 and 4) for MPEG-1 and ISO/IEC 13818 (Vol. 1, 2 and 3) for MPEG-2 basics.*

Starting the ES Analyzer

The program can be started by selecting the ES Analyzer option from the Start > Programs menu or by double-clicking on the ES Analyzer shortcut on the desktop.

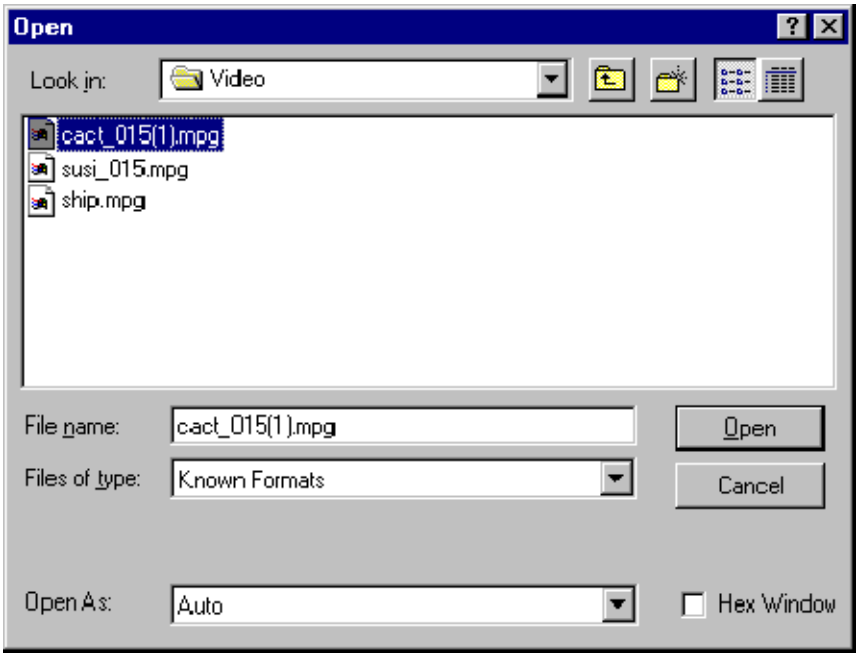


Initially an empty shell window is displayed. It is necessary to open a stream before any screen details can be seen.

Opening an MPEG Stream

1. To open a file, select the Open… option from the File Menu or select the corresponding icon on the toolbar.

   The following dialog box appears:



ES Analyzer displays a standard windows Open dialog box with two additional fields: Hex Window and Open As.

2. Select the file you want to open.

   The types of files that can be opened are as follows:

   - Transport stream files
   - PES stream files
   - Elementary stream files
   - MPEG-1 and MPEG-2 files
   - Regression scripts
   - Mask files

***NOTE**. If you want ES Analyzer to automatically detect the type of MPEG stream the file contains, let the default Auto remain in the Open as field.*

If you want to open the file as a specific type of stream and do not want ES Analyzer to detect it, select the stream type in the Open as field.

If you open an MPEG stream as an incorrect stream type, numerous errors may be reported and ES Analyzer may also behave unexpectedly.

If you open an ATSC stream as auto and the stream contains no PSIP service information, the AC-3 audio may appear as *and not decode. Close the file and reopen with ATSC Stream selected from the Open as field; the AC-3 audio will now decode correctly.*

3. Enable or disable the hex window.

ES Analyzer parses and demultiplexes the opened MPEG stream, and displays the packet header fields in two formats—interpreted and hexadecimal.

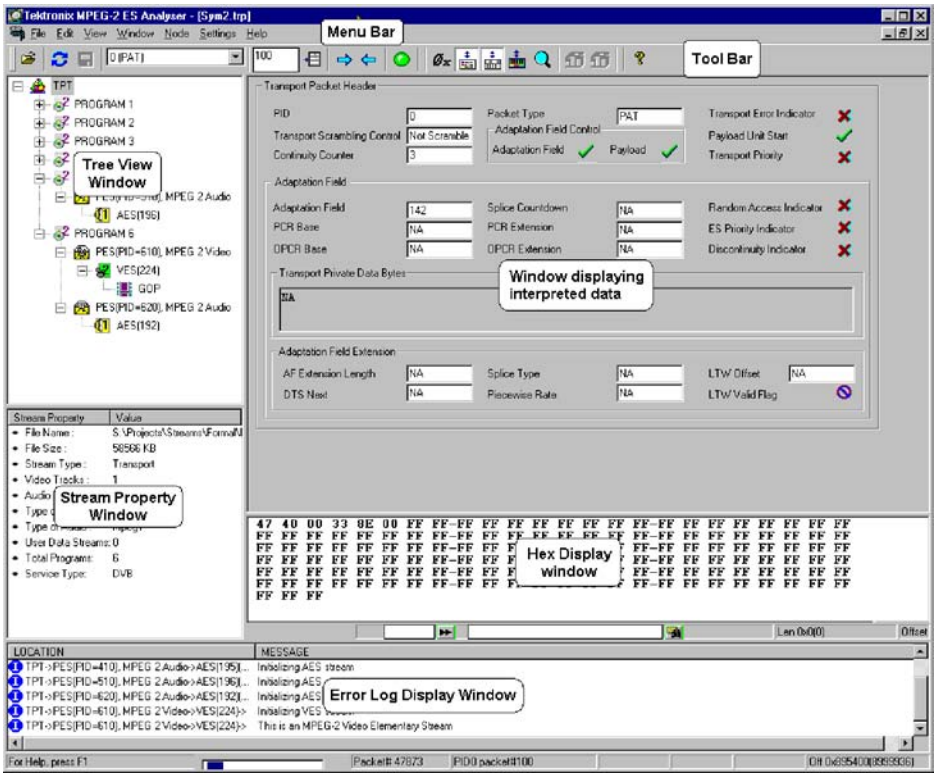
- If you want ES Analyzer to display the packet header fields in both the formats, interpreted and hexadecimal, check the check box next to Hex Window. (The hexadecimal format is displayed in a separate window.)
- If you want ES Analyzer to display the packet header fields only in the interpreted format, let the default remain. (By default, the check box next to Hex Window is clear.)

***NOTE**. If you do not enable the Hex Window when you open a stream, you cannot enable it later when ES Analyzer is parsing the stream.*

4. Click Open when you are through with this dialog box.

Understanding the Main Window and Icons

ES Analyzer allows you to view multiple programs and streams simultaneously. The tree view area on the left side displays the stream hierarchy. For the currently selected stream, the details of the header are shown on the right side. Errors, if encountered, are logged in the error log window at the bottom. A summary of the stream parameters is displayed in the Stream Property window. The status bar at the bottom of the window displays the current status and stream characteristics.



Tool Bar

The tool bar provides a means of accessing frequently used menu bar commands quickly; each icon represents a menu bar item. Icons will display a tooltip description when the cursor is rested over it. The tool bar illustration below does not show all of the buttons.

The table below lists the function of each icon and also indicates when the icon is available. Availability refers to an icon being enabled or disabled with respect to selected nodes in the left tree view window; disabled icons are 'grayed out'.

You can toggle the tool bar display by selecting/deselecting the Toolbar command on the View menu.

Table 5-1: Tool Bar icons

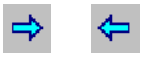
Icon	Function	Availability (Enabled/Disabled)	Menu Bar equivalent
	Opens an MPEG stream, a saved regression file (.REG file by default), or dumped reports	Always enabled	File > Open…
	Restarts analysis from the beginning of the selected parent or child stream	Enabled for all nodes	Node > Intialize
	Extracts a PES, Audio, or Video stream from a multiplexed stream	Enabled for all the embedded stream nodes (PES, VES, AES)	Node > Dump Stream
	Allows navigation to the selected TPT packets; used in conjunction with the Next icon	Enabled for Transport and Program	-
	Enables navigation to the nth packet at TPT node or the nth GOP at GOP node or nth frame at AES node. Used in conjunction with the adjacent button	Always enabled; disabled only for VES node	-
	Allows navigation to the next/previous packet of the selected node	Always enabled; disabled only for VES node, or at end of file	Next/ Previous Packet/ GOP
	Toggles Start and Stop to run through Test mode	Only enabled at GOP level	Start Stop
	Toggles between hexadecimal and decimal display of data in fields	Always enabled	-
	Shows or hides the error log window	Always enabled	-
	Shows or hides the Hex Viewer, which displays data in hexadecimal format	Enabled if Hex Window is checked when opening a stream, otherwise always disabled	-

Table 5-1: Tool Bar icons (Cont.)

Icon	Function	Availability (Enabled/Disabled)	Menu Bar equivalent
	Enables or disables packet view analysis that displays the PID spectrum	Enabled only for PES	-
	Allows zooming into any part of data being displayed; useful when viewing Motion Vector Display in the Slice And MB tab	Always enabled	-
(left icon)	Shows Frame Size Statistics for different frames within a GOP	Enabled only for GOP node (Disabled if the Picture Player tab is selected)	Frame Sizes
(right icon)	Shows Slice Size Statistics, i.e., information about the sizes of the slices within a Picture in a GOP	Enabled only for a GOP node from within the Slice And MB tab	Slice Sizes
	Allows viewing the version and copyright information	Always enabled	Help Topics

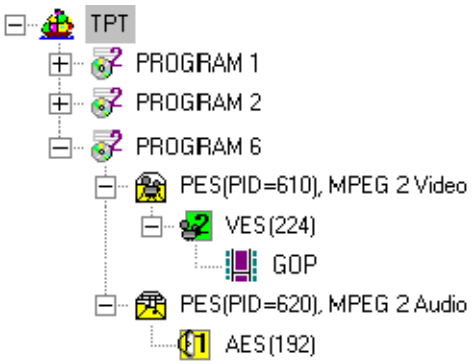
Working with ES Analyzer Commands

When using ES Analyzer, you can issue commands in one of three ways:

- By clicking commands on the menu bar; this also includes the keyboard shortcuts, which are shown next to the menu bar entries
- By clicking icons on the toolbar
- By clicking the right mouse button and selecting a command on the quick menu

After you have invoked ES Analyzer, you need to select the bit stream file you want to be analyzed by clicking Open on the File menu or by clicking the appropriate icon on the toolbar. If the bit stream file is a valid MPEG file, ES Analyzer displays the first packet of the top level stream. Now you can use commands, described below, to navigate randomly to any part of the stream. You can also run through a selected embedded stream using the Go command.

Tree View and Navigation



The tree view window displays the stream hierarchy of the currently opened bit stream file. Each node in the tree view represents a level of hierarchy and is displayed with:

- An associated icon (the icon varies depending on the type of stream that the node represents; these are displayed in the following table).
- A tip that describes the kind of stream represented by the node.
- The PID associated with the node, if applicable.

Table 5-2: Navigation icons

Icon	Stream type representation
	Transport stream.
	Program stream.
	System stream.
	Packetized elementary stream (PES); PES containing a video or audio stream, respectively.
	Audio stream; an MPEG-1 and/or MPEG-2 audio stream.
	Teletext.
	Dolby AC-3 audio stream.

Table 5-2: Navigation icons (Cont.)

Icon	Stream type representation
	Video stream; an MPEG-1 and/or MPEG-2 video stream. If Closed Caption data is detected during analysis, 'CC' is added to the video icon.
	User data stream.
	Group of pictures (GOP).
	DVB subtitle PES.

Suffix 1 and 2 in the Tree View icons (Video and Audio Elementary Streams) refer to MPEG-1 or MPEG-2. Note that MPEG-2 streams can contain MPEG-1 audio information.

***NOTE**. If packets are scrambled or if stream analysis (AAC Audio) has been excluded by dongle, ES Analyzer does not display them.*

Navigating through Streams

When an MPEG file is initially opened, ES Analyzer automatically determines the kind of MPEG stream it is. For a valid MPEG bit stream, ES Analyzer opens the tree view with a node for the top level stream contained in the file. By default, the stream hierarchy is expanded to only one level. You can expand/collapse a node by clicking it. You can select the stream to be viewed at any level displayed in the tree view window by simply clicking the left mouse button on the specific node. Automatically, the window on the right is refreshed to display the header and related information for the selected node.

ES Analyzer gives you full flexibility in viewing streams at any level. You can navigate through the stream independently at each level of the stream. For example, you may be viewing the first PES packet of a PES Stream, but in the embedded VES stream, you may be viewing the last GOP that is not contained in the first PES packet.

Using GoTo, Next and Previous Commands. These commands are applicable to all types of streams and assume that you have opened a valid MPEG file. Each of these commands can be executed for any node that is displayed in the stream hierarchy tree where each node is either a GOP or a valid MPEG stream (embedded or top level).

- Step forward/backward to the Next/Previous packet or GOP in a video stream for the selected node.
- Position the file pointer to the nth packet or GOP in a video stream or frame in an audio stream for the selected video/audio node.
- Position the file pointer to the nth packet of the selected PID; this is applicable to MPEG-1 system streams and MPEG-2 transport and program streams.
- Position the file pointer to the first packet of the selected node.
- Save the embedded stream corresponding to the selected node in a separate file.
- Toggle between hexadecimal and decimal display.
- Use the Transport Stream PID drop-down list to select a PID and navigate to the selected PID using the Next button.

Header, Extension and Hex Displays

Header Display Window

The header display window shows the current header and related information for the selected node in a read-only mode. The fields are interpreted and displayed. The header is not displayed syntactically. Wherever field codes represent specific values, the corresponding value is shown rather than the code itself. For example, in a video sequence, although Chroma format is a two-bit code, it is displayed with the interpreted value of 4:2:0 or 4:2:2 or 4:4:4.

You can view field values in decimal or hexadecimal format by clicking the appropriate icon on the toolbar. One bit fields are displayed using one of three icons:

Table 5-3: Header icons

Icon	Field value representation
	One-bit field was set to 1
	One-bit field was set to 0
	One-bit field is not applicable here

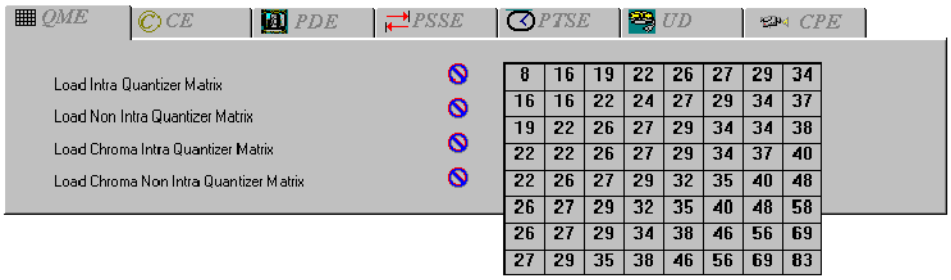
Almost all MPEG headers allow stuffing bytes and have marker and unused bits defined in their syntax. Although all these are parsed and checked for correctness, they are not displayed since they do not provide any meaningful information.

Wherever appropriate, ES Analyzer provides visual feedback, by the use of color, to represent different states.

Extension Displays

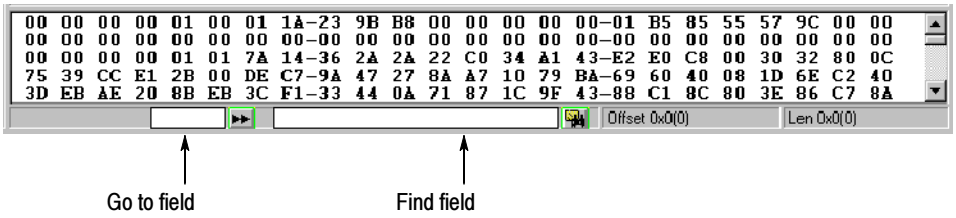
Besides this generic structure, individual headers may have special displays. For example, the video sequence header has a lot of information to be displayed in a small area. This is achieved by using tabbed folders for all the MPEG-2 extensions (see the following illustration). The tab corresponding to an extension is disabled if the corresponding extension does not appear in the sequence header.

When an extension appears in the video sequence, its presence is also communicated by the changed color of text (in red) on the corresponding tab.


QME
CE
PDE
PSSE
PTSE
UD
CPE
Load Intra Quantizer Matrix
Load Non Intra Quantizer Matrix
Load Chroma Intra Quantizer Matrix
Load Chroma Non Intra Quantizer Matrix
8 16 19 22 26 27 29 34
16 16 22 24 27 29 34 37
19 22 26 27 29 34 34 38
22 22 26 27 29 34 37 40
22 26 27 29 32 35 40 48
26 27 29 32 35 40 48 58
26 27 29 34 38 46 56 69
27 29 35 38 46 56 69 83

Hex Display Window

The hex display window shows a hexadecimal dump of header bytes contained in the header being currently displayed in the header fields display window. This is useful if you are used to viewing the headers in the hexadecimal format rather than the interpreted format that is displayed in the header display window. Also able to be displayed are sequence information at VES level and frame information at GOP level (as shown below).



The data collection for the hex display window can sometimes be memory intensive and can affect ES Analyzer's performance. You can turn on the hex display or turn it off according to your requirements by checking or clearing the

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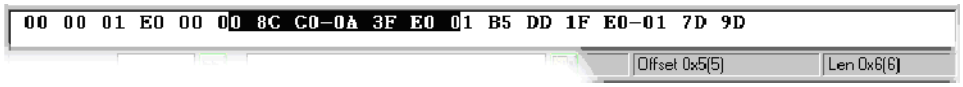
check box next to Hex Window in the Open dialog box. If you have not enabled the Hex Window option when opening a stream, you will be unable to open it when ES Analyzer is parsing the stream. However, you can dynamically turn off the Hex Window, whenever you want, by clicking the Show/Hide Hex Viewer icon on the toolbar if you enabled it when you opened the stream (see details in the *Opening an MPEG Stream* section).

The hex window displays a hyphen (-) after every eight bytes for display purposes. The status bar in the hex window displays the current cursor position's byte offset from the start of the header. If you select a sequence of bytes in the hex window, the size and the byte offset from the start of the selection appears in the status bar when you release the mouse button.



To search for a specific byte pattern in the Hex Window.

1. Type the pattern in the Find field, on the left of the Find button, on the status bar.
2. Click the Find button.

   The specific pattern will be searched from the current cursor position. If the pattern is found, it is highlighted in the hex window. If the pattern is not found, you will hear a beep. The search loops back to the beginning of the file and subsequent occurrences of a pattern can be found by clicking the Find button.

To position the cursor to a specific byte location from the start of the packet header.

1. Type the byte position in the Goto field, on the left of the Goto button, on the status bar.
2. Click the Goto button.

   You will be positioned to the corresponding byte location in the header in the hex display window.

Summary of Displayed Information (Header and Hex displays). Table 5–4 summarizes the information displayed in the hex window that corresponds to the information displayed in the header display window.

Table 5-4: Hex Headers Display

Header display window information	Hex dump in the hex display window
Transport packet header.	Header data of the current packet.
PES Header.	Header data of the current packet.
MPEG-2 Program stream - Pack Header.	Header data of the current packet.
MPEG-1 System Stream - Pack Header.	Header data of the current packet.
Video stream - Sequence header / sequence extension.	All the video level information which is above the GOP level.
Video stream - When viewing picture at Picture or Slice level display (with video analysis setting set to Macroblock level).	All the information for the currently selected picture. When the first picture is selected in the picture slider, data corresponding to the GOP header (if available) along with first picture data appears. For all pictures other than the first picture in the GOP, only picture data is shown. The subsequently read sequence header and extension data is updated in VES node.
Video stream - Hex data display when viewing picture at Slice level display (with video analysis setting set to Picture level).	Same as above.
Video stream - Hex data display when viewing picture in Picture display form (with video analysis setting set to Picture level).	Same as above, but with the following exception. Picture data includes only picture header and extension data. No slice or macroblock level data is shown. However, when you go down to the slice level display by clicking the Slices button, ES Analyzer appends slice and macroblock data in the current picture data for the hex viewer. When you return to the Picture display dialog, ES Analyzer continues to show the complete picture data. The pictures for which you do not step down to the slice level, you'll still be shown picture data that includes only the picture header and extension data.
Audio Stream	Both frame header and audio data is shown.

Error Testing Methods and Outputs

ES Analyzer can error check an entire stream in an automated manner (regression test). Part of a stream, triggered from a node for a specific program, can be manually checked (run though mode).

Regardless of the stream type, testing is only possible at the compression layer; it is the task of TS Analyzer and PES Analyzer to test at the systems layer. However, you can still view the headers of the transport and PES packets, but note that no tests are performed (either run-through or regression).

Both test modes will produce screen or file output error messages. Manual test is also possible by examining the various block/slice/vector and picture display menu screens.

Error filters can be applied to the tests, and fields selected to allow diagnostics up to the error point to be dumped in a file for ‘pre error point’ analysis.

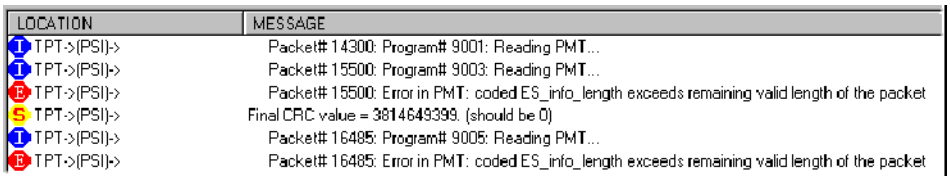
Run Through Stream Test Mode

This is operated by highlighting the test node - usually the GOP filmstrip icon - of the appropriate program, then clicking on the Start/Stop (green ball) in the top toolbar.

The stream will be run though and errors reported in the error display window.

Error Display Window

The error display window displays information, warning and error messages generated by the run-through test mode for a specific program node.


LOCATION
MESSAGE
TPT->(PSI)->
Packet# 14300: Program# 9001: Reading PMT...
TPT->(PSI)->
Packet# 15500: Program# 9003: Reading PMT...
TPT->(PSI)->
Packet# 15500: Error in PMT: coded ES_info_length exceeds remaining valid length of the packet
TPT->(PSI)->
Final CRC value = 3814649399. (should be 0)
TPT->(PSI)->
Packet# 16485: Program# 9005: Reading PMT...
TPT->(PSI)->
Packet# 16485: Error in PMT: coded ES_info_length exceeds remaining valid length of the packet

For each message, the following are shown:

- An associated icon that indicates the kind of message (the icons E, I, and S shown below indicate a syntactic error, information, and a semantic error, respectively):

  where:
  E = protocol syntax (Rules) error.
  S = semantic-parameter or data range error.
  I = Information only; not an error.
  Both E and S should be regarded as errors.

- A string that identifies the exact location in the bit stream where the error was encountered; the format of the string is:

  ```
  (STREAMTYPE) -> (STREAMTYPE, STREAMID) ->
  (NODE) (packetNumber)
  ```

  For example, the following string identifies an error in packet number 2 of the MPEG 1 audio stream on PID 210:

  ```
  TPT->PES(PID=210), MPEG 1 Audio->AES0(2)
  ```

- The message string associated with the message.

Double-clicking a message in the error display window lets you view more detailed information about the message.

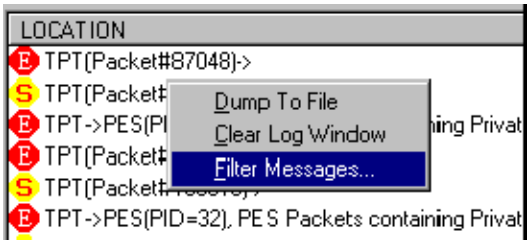
Error Filtering

Configuring and Filtering Messages for Display

You can configure and filter the kinds of messages you want ES Analyzer to report. You can turn on/off messages of any type (Information, Errors, Semantic checks) to be reported for the entire stream, or any node in the stream hierarchy displayed in the tree view. You can also store the displayed messages in a file or clear the message window.

To configure messages:

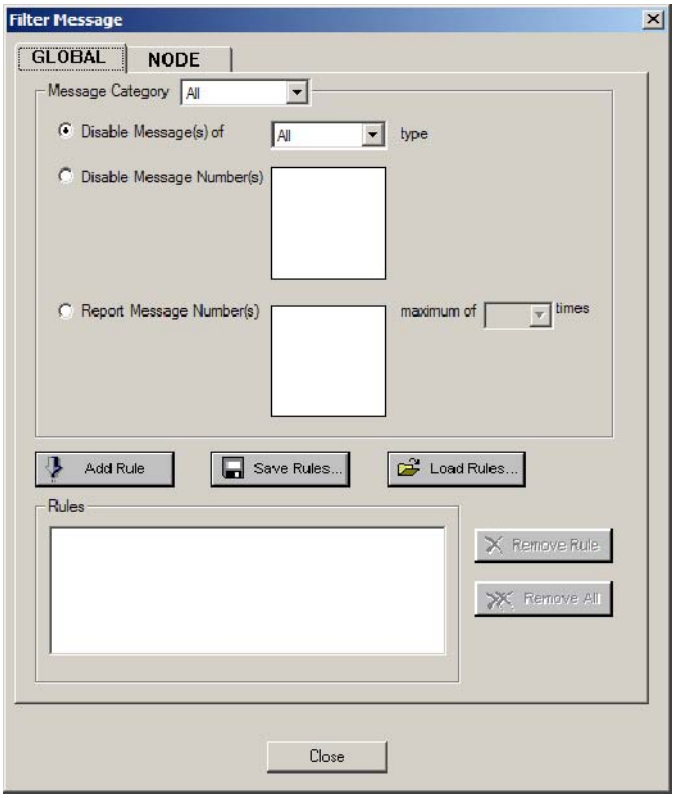
1. Click the right mouse button anywhere in the error display window.



2. Select Filter Messages from the context menu that appears:

The Filter Message dialog is displayed. The dialog box contains two tabbed pages: Global and Node.

Message Filtering - Global. The Global Message Filter tab provides settings that can be used to select which messages are enabled and disabled and how many times enabled messages are to be displayed. The rules created are global; that is, they will be applied to all nodes in the active stream. Rules to be applied to a single node (such as PSI, PES, VES) can be added from the Node tab.



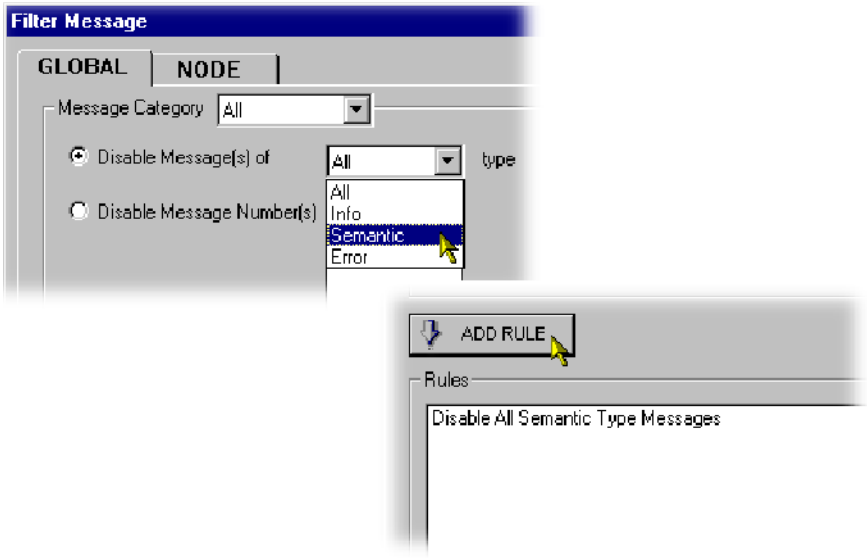
The top half of the Global tab contains:

- A drop-down list from which the category of messages can be selected to which rules are to be applied, and
- Three options for the display of messages.

As rules are created using these fields, they should be added to the Rules text field below by selecting the Add Rule button.

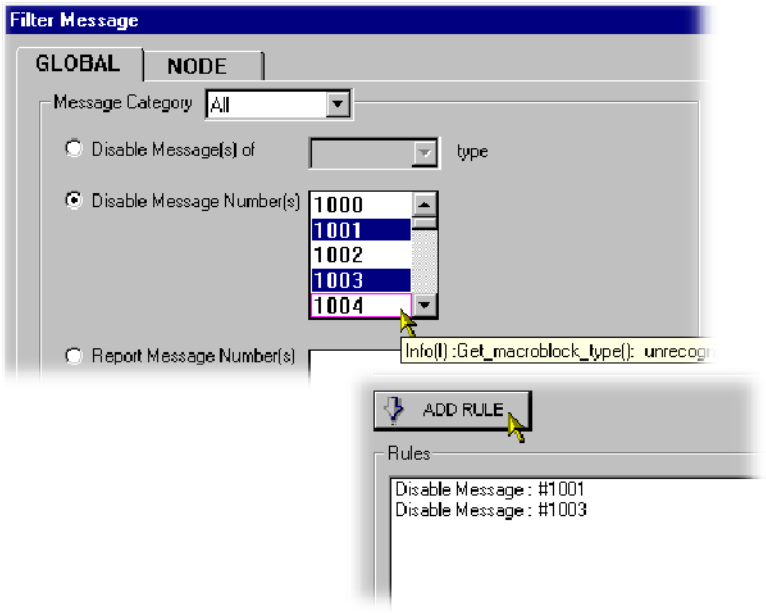
The three options are as follows:

- Disable all messages on the basis of severity, that is, Info (I), Semantic (S) or Error (E).
  Enable the Disable Messages(s) of checkbox, select the type of message to be disabled and press the Add Rule button. Note that the rule is added in the Rules text field.

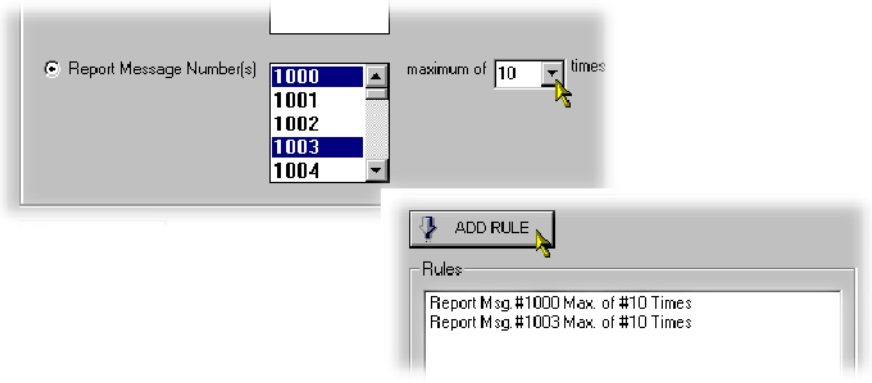


- Disable messages on the basis of message number.
  Each message is assigned a unique number based on the type of streams it is related to; a tooltip will be displayed when the cursor is passed over the message number. Enable the Disable message Number(s) checkbox, select

the message numbers to be disabled and press the Add Rule button. The Shift and Control keys can be used to make multiple selections. Note that the rule is added in the Rules text field.



- Report repeated messages only a specified number of times.
  Enable the Report Message Number(s) checkbox and select the message numbers to be disabled. The Shift and Control keys can be used to make multiple selections. Select the maximum number of times that the message is to be reported and press the Add Rule button. Note that the rule is added in the Rules text field.



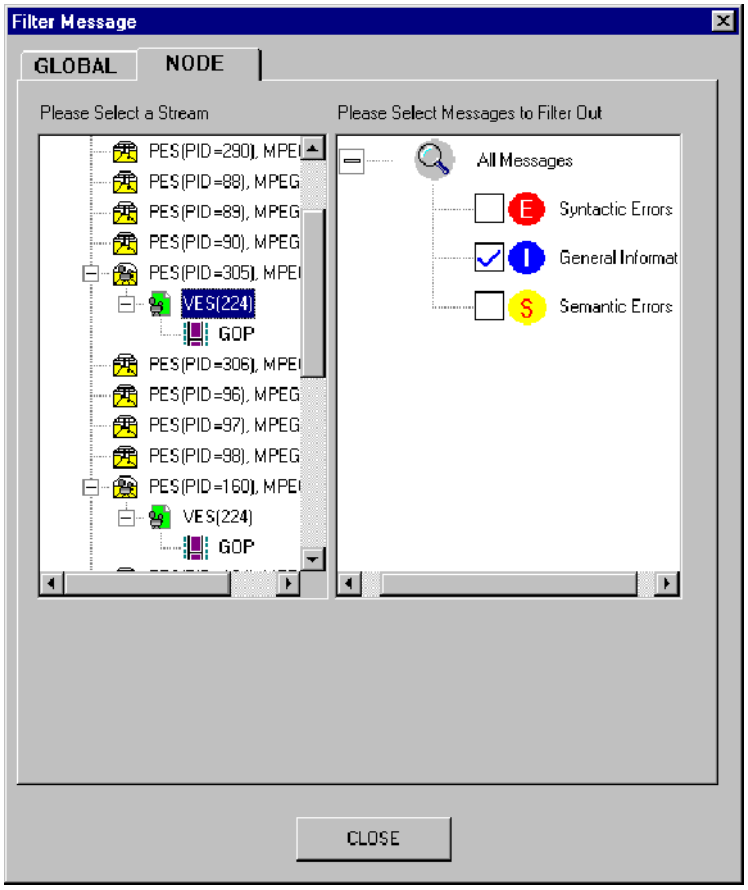
Combinations of message rules can be created; they will need to be created and added one at a time.

Rules can be removed individually (Remove Rule button) or globally (Remove All button). Rules that are already set cannot be edited; they must be removed and recreated.

Rule sets can be saved and reloaded as required using the Save Rules… and Load Rules… buttons.

Message Filtering - Node.

1. Select a stream in the left scroll window and then select the types of messages you want to be filtered out. By default, all messages are displayed for a stream.



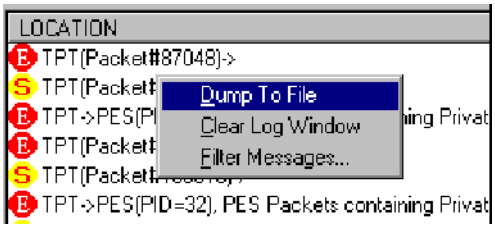
- If you want your message filter(s) to be applicable to all streams opened until now, select it for the entire World. This option will apply the filter(s) to all nodes displayed in the tree view window.

- If you want your message filter to be applicable to all streams, irrespective of whether they are opened or not, click the Set for all Streams button.

2. Click OK to accept to changes; Cancel to close the dialog box without applying the changes.

To store the displayed messages:

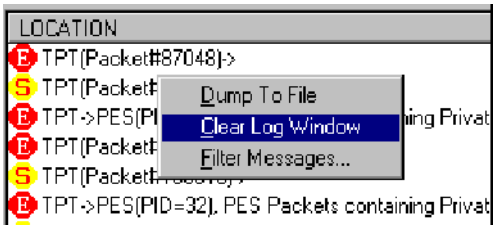
1. Click the right mouse button anywhere in the error display window.
2. Select Dump To File from the menu that appears.



3. The Dump Message dialog box is displayed. Enter the name of the file in which you want to store the messages.
4. Click the Save button when done.

To clear the windows

1. Click the right mouse button anywhere in the error display window.
2. Select Clear Log Window from the menu that appears.



Status Bar

During regression and run-through mode, progress through the stream is indicated by the status bar at the bottom of the main window. The status bar is split into multiple fields and displays the following:

- A progress bar indicates the approximate byte position in the file for the currently selected stream.

***NOTE**. Since you can view each embedded stream inside a multiplexed stream independently, it is possible that in each embedded stream you may be viewing packets which are far apart in the stream. In such cases, the file pointer will be at different positions for each embedded stream and the file progress bar is updated according to the stream being currently viewed. In addition, the byte offset in the file for the currently displayed unit of data is also displayed in the status bar. For example, when you are viewing a Packetized Elementary Stream (PES), the byte offset of the first byte of the start-code of the currently viewed packet in the opened file is displayed in the status bar. Similarly, when viewing a GOP in a Video stream that is embedded in a Transport stream, the byte offset of the start code of the corresponding GOP in the file is displayed in the status bar. More details are given with the explanation of status bar with each individual stream.*

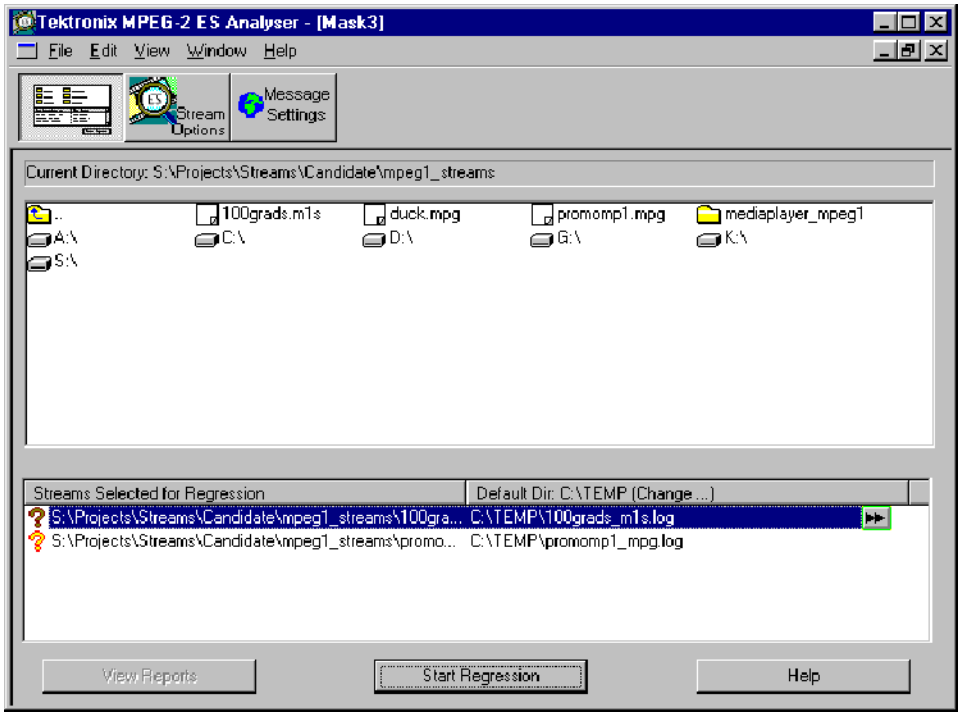
- Characteristics of the stream being currently viewed. These vary with the stream and are described in detail for each stream in subsequent chapters in this book.
- The state of the status bar display can be toggled by selecting/deselecting the Status Bar command on the View menu; that is, View > Status Bar.

Regression Testing and Error Log Files

With ES Analyzer, you can regression test MPEG streams (with errors being saved to log files) and save data from selected fields to report files for viewing later (see the section Reviewing a Report for details).

Regression Test Window

To perform a regression test, close the file, if it is open, using the File menu. Select File > New Regression Script…. Note that disk drive icons are displayed on the right side of the directory window; you may need to scroll right to view/access them.



Double-click on the file you require and it should appear in the lower window Streams Selected for Regression with an orange question mark to the left of the file name.

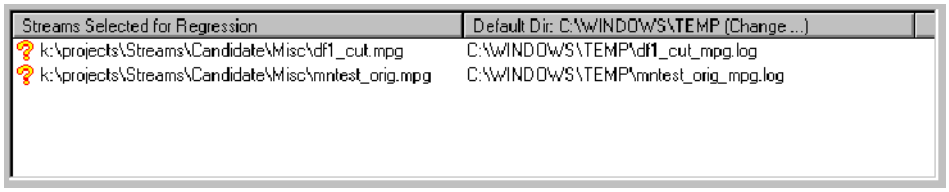
When regression is done, this will turn to a red or green ball, depending on the errors found. A default log file name is entered; it can be renamed by clicking on the double-arrow button to the right of the name. After regression testing, the log file can be viewed by double-clicking on the log file name.

Error messages written to the log file can be controlled via the Message Settings screen.

The button View Reports is only available to show dump/.dat files if they have been set up beforehand (see Select Fields and Reviewing a Report sections).

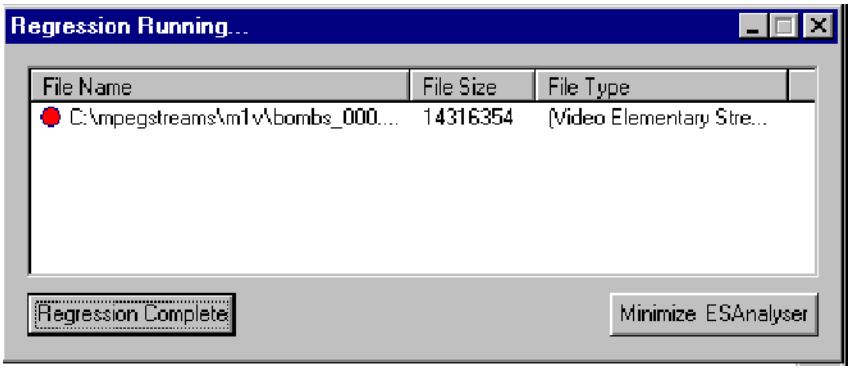
Setting up the Regression

You can select multiple streams for regression from the displayed list of files. (To select multiple files, double-click a file or select it and then drag-and-drop it in the lower window.) The streams selected for regression appear in the lower window.



For each stream, the following are displayed:

- File name.
- Default log file where the messages for the stream will go. You can change this by clicking the icon displayed next to the log file name. ES Analyzer displays a default directory where all log files are created that store the results of the regression. You can change the directory for storing log files by clicking the Default Dir… button.
- The stream type. Initially this is not known and is set to Unknown. Once the regression is complete, this is updated to reflect the type of stream that the file contains.
- An icon indicating the state of the stream. Initially, when a file is selected, the icon appears as a question mark indicating an unknown status. After the stream is regression tested, the icon changes to red if the regression reported errors, or changes to green if there were no errors.



For a regression test, you can also select embedded streams that correspond to nodes in the tree view for a stream hierarchy. You can do this by clicking the Streams Option button in the regression test window; see Reviewing a Report below. This displays the settings for the current stream. By default, the tests are enabled for all types of streams, which you can disable. Saving a regression script also saves these settings.

Running the Regression

Once you have set up a regression script, you can run it by clicking the Start Regression button. A status window displays the continuous status of the regression. If you want, you can cancel the regression anytime by clicking the Cancel Regression button in the status window. When the regression is complete, the state of the regression run on each stream is displayed in a dialog box through the changed icon which is red (for failure) or green (for success), and the updated file type. The icon remains a question mark if the file was not a valid MPEG file.

Viewing and Saving Results

You can view the error log file created for any stream after it has been regression tested by double-clicking the specific bit stream file in the regression test dialog box. You will need to associate files of the type *.log with a text editor of your choice. You may do so through the Explorer. Click View > Options to display the Options dialog, and then click the File Types tab. By default, ES Analyzer opens the log files with the application with which they are currently associated.

You can save the regression script and the results in a regression script. To save the file, choose Save As from the File menu. The file is saved as a binary file and also saves the regression results. You can reload the regression file including the results of the last regression whenever you want. Regression can also be run on a previously saved regression script file.

Message Settings

Messages sent to the log file can be controlled through the Message Settings dialog box. Rules to be applied to messages can be created as required. The operation of this dialog box is similar to Message Filtering as described on page 5–17.

Reports and Field Selection

You can save and review reports consisting of field value dumps of specific fields when you regression test a stream. To review a report, it must first be created by selecting the fields to be viewed, then setting up and running the regression, and finally selecting the View Reports button (it is also possible to select and open multiple reports).

Creating a Report

A regression report is packet-by-packet details listed with information fields you can choose. A report is not an error list, although errors detected may appear in it. A report can be used to examine run-ups to problems (pre-trigger).

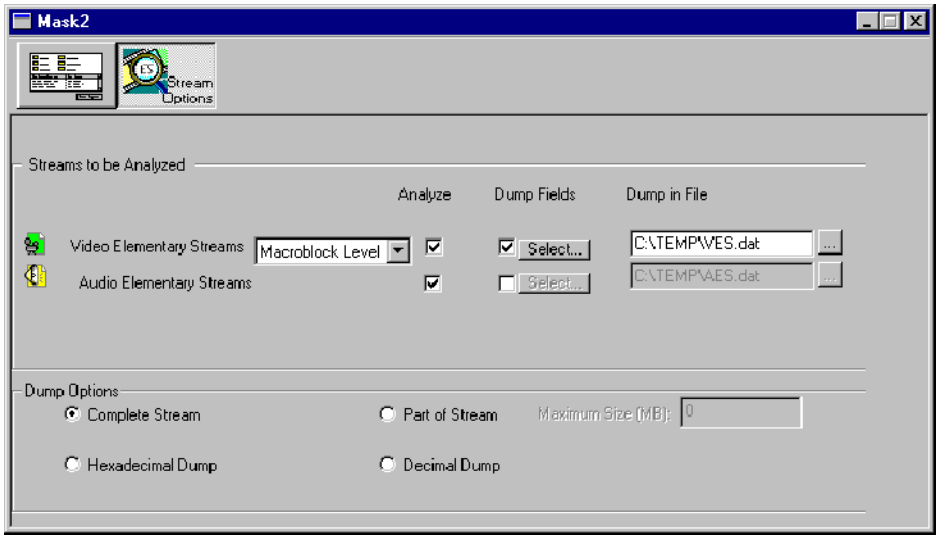
Before starting a regression test, select the Stream Options button in the Regression test window. Ensure that the Dump Fields check-box is enabled and select the adjacent Select… button. You can then add the fields to be listed in the dump file columns (individual fields or all fields).

You can check the dump in file box and name your dat file or use the default VES.dat or AES.dat.

Do this for video & audio elementary streams.

To select fields.

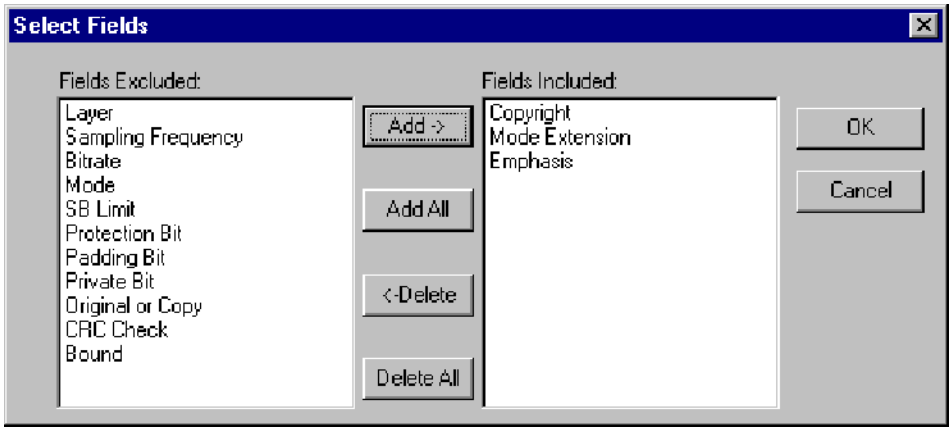
1. Click the Stream Options button in the regression test window to display the following screen.



2. Enable and disable the streams using the checkboxes in the Analyze column.

Deselect the streams you don't want ES Analyzer to analyze. By default, all the streams are selected.

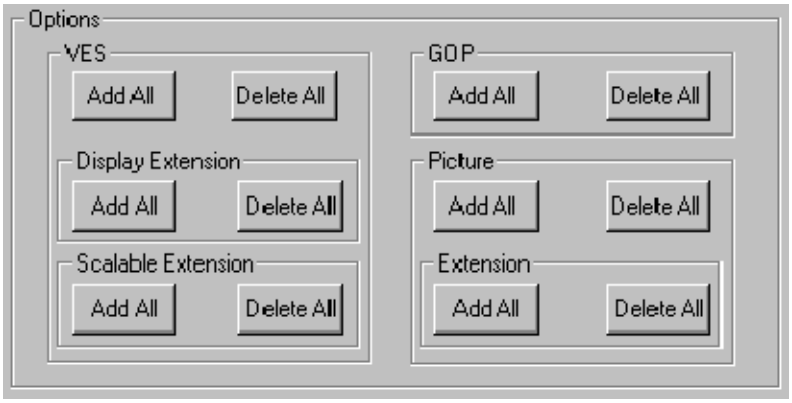
3. If you want to analyze Video Elementary Streams, you may either select Macroblock Level or Picture Level from the adjacent drop-down list.
4. Select the streams for which you want to dump data by enabling the checkbox under the Dump Fields column.
5. Click the highlighted Select… button to display the Select Fields dialog box.



6. Finalize the list of names by adding/deleting the field names in the Fields Included list box and click OK.

   You may also double-click a field name displayed in the left list box to include it in the right list box.

- If you have selected a video elementary stream, ES Analyzer also displays options in the Select Fields dialog box.



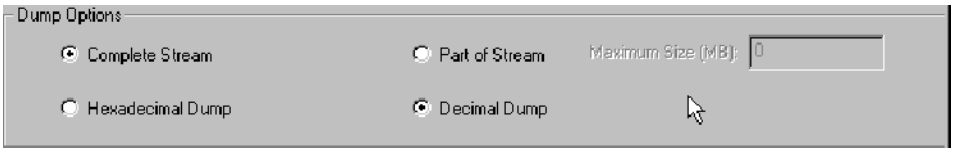
You may click the appropriate buttons to select fields specific to these options. This is a quick way to add/delete specific fields into the Fields Included list box; otherwise, you will need to manually find and add fields from the Fields Excluded list box.

For example, if you have added all the fields from the Fields Excluded list box, and now want to delete VES-related fields from the Fields Included list box, you may click the Delete All button in the VES section. You can also click the Add All button under Display Extension to add related fields to the Fields Included list box.

7. Specify the file into which you want the fields to be dumped.

You may type the filename (*.dat) or select one by using the browse button next to the default filename.

8. Specify the dump options.



If you select Part of Stream, the Maximum Size (MB) field is enabled and you'll need to specify the size of the stream from which the fields will be dumped.

Once you have specified the fields, return to the regression test window by clicking the button next to the Stream Options button.

Reviewing a Report

A sample report looks like this:

```
Collecting Statistics for
“C:\mpegstreams\mls\bird4.mpg”
Date 04/02/98          Time: 16:38:42

Packet                 Fixed      Audio
No.          SCR       Flag       Bound
1            0         1          1
2            1083      1          1
3            2167      1          1
4            3250      1          1
5            4334      1          1
6            5417      1          1
7            6501      1          1
8            7585      1          1
9            8668      1          1
10           9752      1          1
```

(Note that these ‘dump’ files have the default extension of .dat.)

Demultiplexing Transport Streams to PES or Elementary Output Files

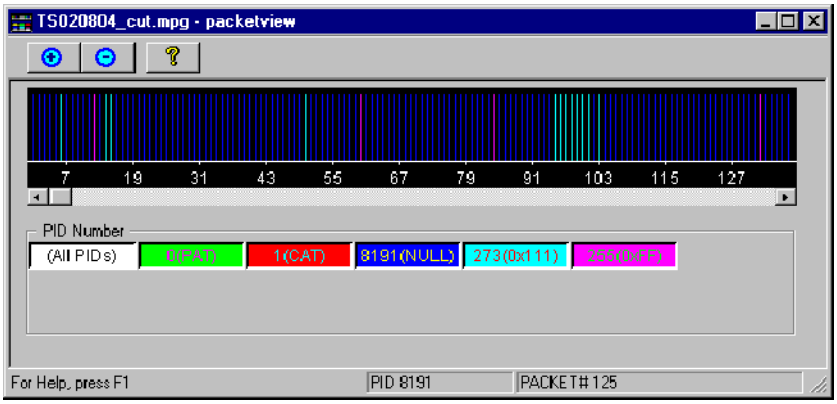
It is possible to select a given stream node in navigation view (such as PES video/audio) or VES audio/video (but NOT gop). The diskette icon will highlight on top toolbar at the left when the function is available. Select the icon, name the dump file and select it’s type if required. ES Analyzer will then create a PES or elementary stream.

This stream can be loaded back into the ES Analyzer to be checked, and then it can be used as input to Multiplexer application to create a transport stream with SI/PSI to your specifications.

Working with Transport and PES Streams

Using Packet View

ES Analyzer displays transport packets in a specific way that is useful for analyzing the Transport stream and also for quickly accessing a packet at random.



The packet view window can be displayed by clicking the Show/Hide Packet View icon on the toolbar. A window appears that shows a spectrum of the packets in the order in which they appear in the transport stream. Each PID is assigned a color and each packet is represented using a single line of the corresponding color. By double-clicking the spectral line for any packet, you are positioned to the corresponding packet in the main window of ES Analyzer.

Packet View communicates with ES Analyzer's main window through OLE. You can selectively turn on/off the display of spectral lines for any PID in the Packet View by clicking the corresponding color index in the Packet View dialog. The color index is also a toggle for display. You can also view distance graph between packets of the same PID by just viewing spectral lines of the corresponding PID. To switch back to displaying all PIDs, double-click the All index (represented by white color).

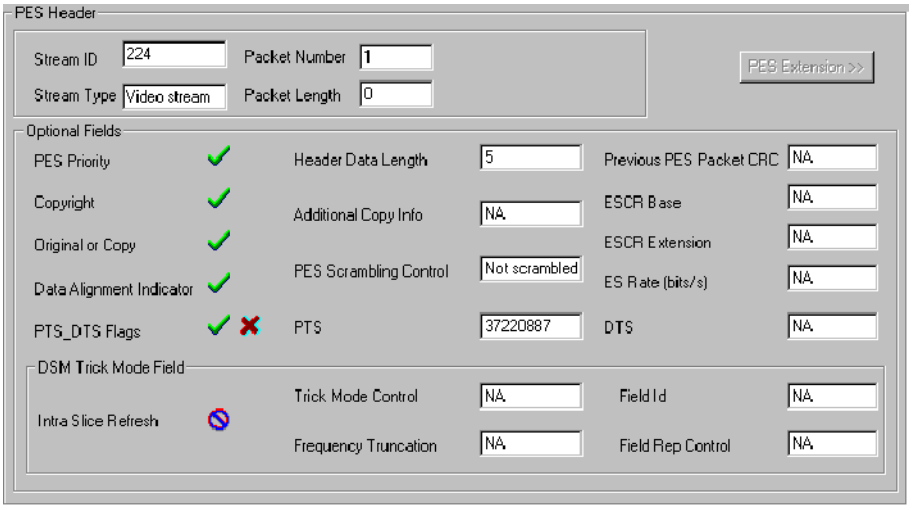
***NOTE**. When you first open Packet View, it displays just the front page of the stream, so that not all of the PID numbers present in the stream are displayed in the button boxes below the main display. If you want to see them all, drag the horizontal scroll bar pointer to the far right; all of the PID number buttons will then be displayed (this could take a few seconds for large stream files).*

Packet view does not operate when a program node is highlighted; it works in all other nodes in navigation view.

Understanding PES

A Packetized Elementary Stream (PES) as the name suggests is composed of contiguous packets of an elementary stream with packet headers, as shown in the following illustration, prepended to the packet. A PES occurs only in MPEG-2 streams and its structure has been adapted from the packet structure of the MPEG-1 System stream.

For more information on PES streams, refer to the ISO/IEC 13818-1 document.



An embedded stream is checked when you navigate through one; for details, see the Navigating through Streams section in the *Getting Started* chapter.

For PES streams, you can:

- Run through the stream; see details in the Navigating through Streams section in the *Getting Started* section.
- View packet headers with their decoded fields.
- View an embedded elementary stream.
- View PES extension (if received).

Explaining the Status Bar Display

The status bar, for PES streams, displays the following:

- Packet number, which is the number of the current packet in the PES stream.
- Byte offset in the file, which is the first byte of the Pack header being currently viewed in both the hexadecimal and decimal formats.

Working with Video Streams

ES Analyzer performs detailed checks on MPEG Video streams. Video streams are complex with an embedded hierarchy. Structurally, a Video stream consists of a video sequence that has a start code, end code, sequence header, and any number of group of pictures (GOP). Each GOP consists of a GOP header and a group of pictures. Pictures may be of different types (I, B, or P). Pictures can also be frame pictures that correspond to progressive video or field pictures that correspond to interlaced video. Pictures are broken down into a slice structure and each slice consists of macroblocks.

For more details, you may want to refer to the documents ISO/IEC 11171-2 and ISO/IEC 13818-2 that describe the MPEG-1 and MPEG-2 video standards.

Using ES Analyzer, you can:

- View the sequence header along with the extensions.
- Navigate through a stream; see details in the *Navigating through Streams*, page 5–9.
- Run through a stream with the option of analyzing the stream at the picture level or at the macroblock level.

When analyzing a group of picture, you can:

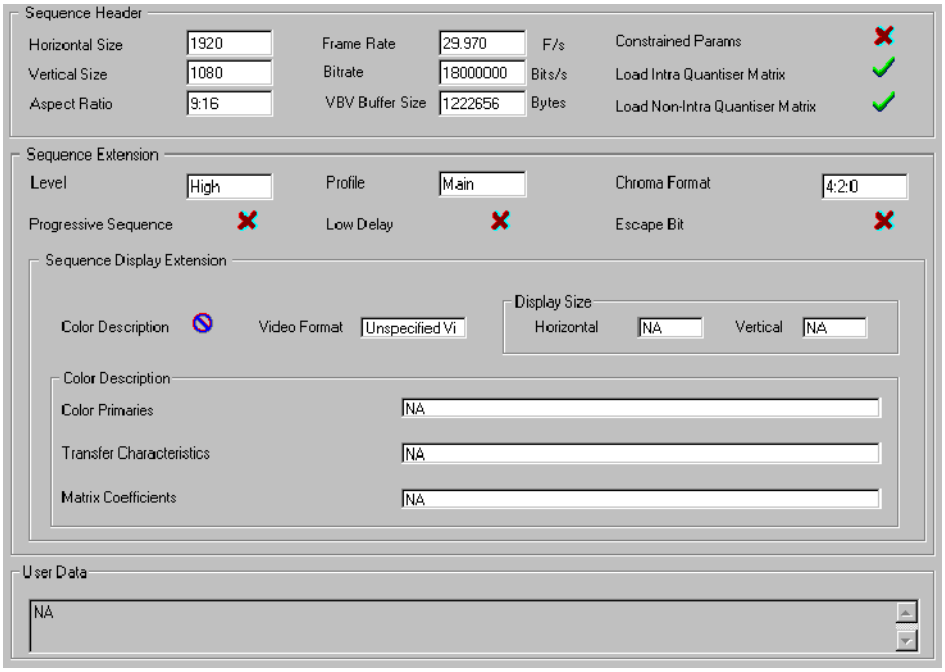
- Randomly access any picture within the group.
- View the picture type spectrum and picture size plots.
- Zoom into any picture and see its details at the slice or macroblock levels, or view the encoded picture. You may also use the video or picture player to play the entire video and pause at any picture when you notice a degradation in quality; you can then review the details of this picture down to the macroblock level. ES Analyzer provides an easy mechanism to switch between the Picture display and the data analysis display windows.
- Select any macroblock and examine its detailed coding.
- Perform picture quality analysis with special displays of quantizer scale distribution, slice size distribution, macroblock-size spectrum and motion vector plots.
- Interpret any video descriptors received in the higher level streams and validate them against the stream.

When analysis with the DCT option is enabled, you can:

- View 8x8 coefficients for all macroblocks within a picture.
- View coefficient tables for y, cr, cb, luma and chroma pixel data.

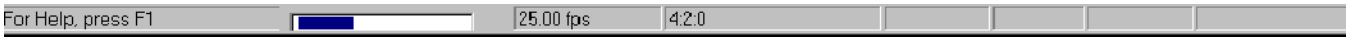
Viewing the Sequence Header

The sequence header is interpreted and displayed as shown below.



***NOTE**. Placing the cursor over either Load Intro Quantizer Matrix or Load Non-Intra Quantiser Matrix, displays the applicable quantizer matrix. The check mark icon indicates that the matrix was received in this sequence header.*

For MPEG-2 streams, an optional sequence extension and user data may also be received. User data is displayed as a hex dump. If data is in the ASCII format, the ASCII equivalent is displayed next to the hex dump.



The picture rate, chroma format, and the video type (NTSC/PAL/Unspecified, etc.) appear in the status bar when the sequence headers are displayed.

The information whether the stream is an MPEG-1 or an MPEG-2 stream is displayed in the tree view window as a single numeral (1 or 2) on the node icons.

Within a sequence, you can view the GOPs by clicking on the GOP icon in the left side hierarchy view of the stream. The GOP node appears below the sequence header node.

Viewing the GOP and Picture Header

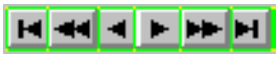
When displaying a GOP, ES Analyzer shows you a window with three tabs, as shown below.

Briefly, the contents of each tab are explained below. For details, see the specific sections: *Displaying the GOP Header*, *Displaying the Slice and Macroblock*, and *Using the Video Viewer for Picture Analysis*.

The GOP tab displays the following:

- GOP header data.
- A slider for the pictures in the GOP. The slider can be used to randomly access any picture within the GOP; the slider moves in steps of two to facilitate working with large GOPs. The slider lists the pictures in the received (decoding) order.

GOP position transport controls lie to the left of the slider bar



Using these controls, any picture can be selected within the GOP. The controls include Start and End GOP controls and Next and Previous I frame jump controls. Note that the I frame controls only works in streams where multiple I frames are present between GOP sequence headers.

- Picture header display for the picture selected in the slider.
- Picture extensions (applicable only to MPEG-2).

The Slice and MB tab:

- Takes you inside a specific picture and provides detailed information down to the macroblock level.
- Allows you to generate picture quality plots.
- Allows you to view a picture frame by frame and view macroblock level data for a selected macroblock in the picture.

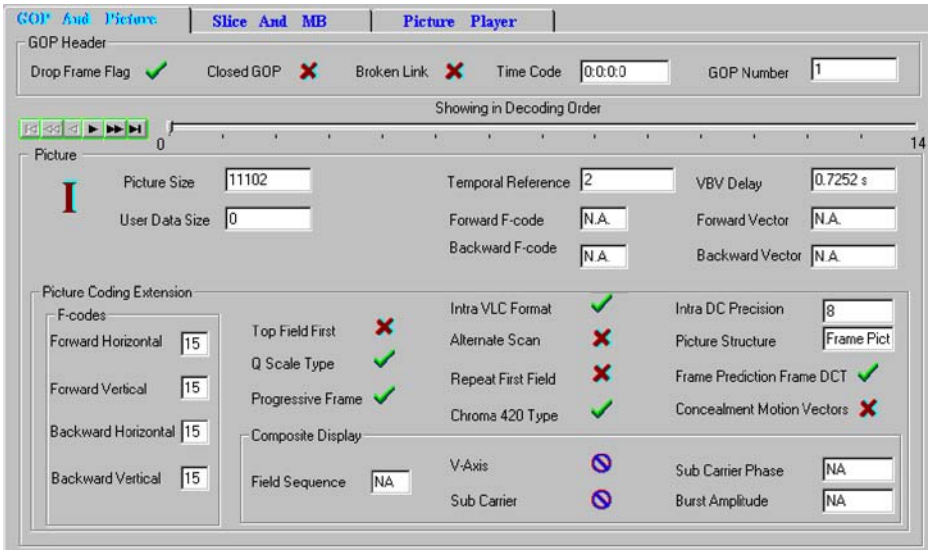
The Picture Player tab allows you to play and view the video output on your screen.

***NOTE**. ES Analyzer synchronizes the picture being currently displayed by the video viewer with the picture/data that is displayed on the other tabs: GOP And Picture and Slice And MB. For example, if you select a macroblock and switch from the picture display to the other picture-quality analysis tabs, the same macroblock remains selected for easy identification.*

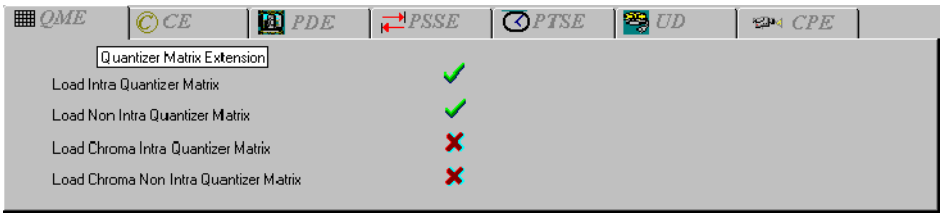
As an aid to locating a stream, you can click on any open GOP icon in the tree view to switch picture displays in the stream multiplex.

Displaying the GOP Header

The GOP header is an optional header and it is displayed, as shown below, when received.

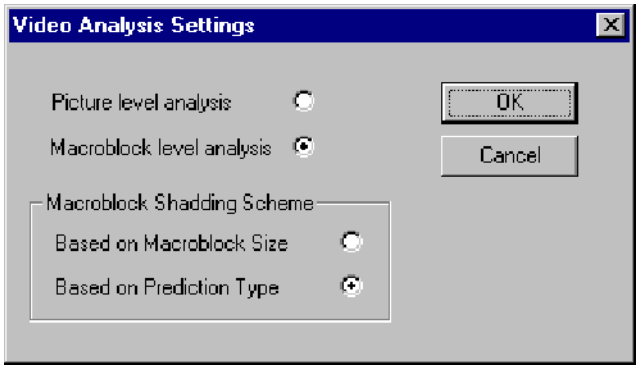


The lower part of the display also shows the picture extensions that have been received.



Video Analysis Settings. Analysis of GOPs can be carried out at picture level or macroblock level. This will affect the speed at which the 'next GOP' is analyzed. The setting is selected from the Video Analysis Settings dialog.

Select Menu Bar > Settings > Video Analysis. The following dialog is displayed:



Picture level analysis provides faster analysis but error reporting at the macroblock level is suspended. Macroblock level analysis provides error reporting but at the cost of analysis speed.

Status Bar (in GOP mode). When ES Analyzer displays the GOP and picture headers, the status bar, as shown below, displays the:

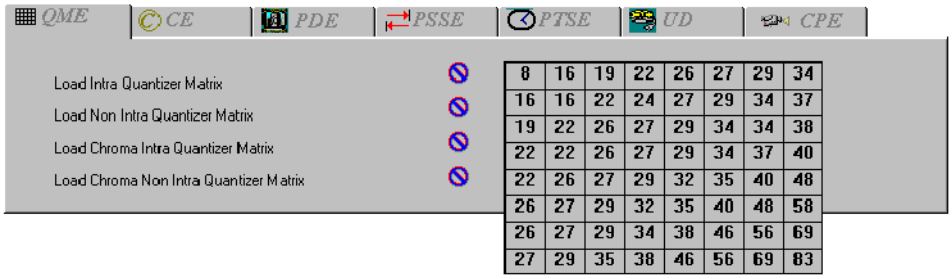
- Picture rate
- Chroma format
- Video Type (NTSC/PAL/Unspecified etc.)
- GOP number of the current GOP
- Picture number of the currently selected picture, relative to the current GOP (the first picture is given the offset 0.)
- Picture display number, which gives the picture number in display order, relative to the first GOP received. This represents the actual picture Display number. It is calculated by adding the temporal reference of the current picture to the cumulative picture display number prior to the GOP.

Displaying the Picture Header

The GOP header tab has a slider for selecting the picture whose details you want to display. The header for the selected picture is displayed below the GOP header in the same dialog box as shown in the earlier illustration.

Displaying the Picture Extension

For MPEG-2, several picture extensions may be received. The picture coding extension is always displayed, while the other picture extensions are displayed on tabbed folders, as shown below. The tabs for each of these extensions are enabled and the text on the tab appears in red, only if the corresponding extension is received in the stream.


QME
CE
PDE
PSSE
PTSE
UD
CPE
Load Intra Quantizer Matrix
Load Non Intra Quantizer Matrix
Load Chroma Intra Quantizer Matrix
Load Chroma Non Intra Quantizer Matrix
8 16 19 22 26 27 29 34
16 16 22 24 27 29 34 37
19 22 26 27 29 34 34 38
22 22 26 27 29 34 37 40
22 26 27 29 32 35 40 48
26 27 29 32 35 40 48 58
26 27 29 34 38 46 56 69
27 29 35 38 46 56 69 83

All tabs with red text represent extensions that have been received for the current picture. The next section describes each extension and its interpretation.

Explaining the Picture Extensions.

QME (Quantizer Matrix Extension)	This allows the quantizer matrices to be downloaded for any picture. At most four matrices can be downloaded, namely, intra-quantizer matrix; non-intra-quantizer matrix, chroma intra-quantizer matrix, and chroma non-intra-quantizer matrix. The QME tab displays through a check mark the matrices that were downloaded. A downloaded matrix is displayed when you move the mouse over the name of the specific matrix.
CE (Copyright Extension)	This indicates any copyrights on the video. The copyright field is interpreted and displayed.
PDE (Picture Display Extension)	This extension gives display extensions for MPEG-2 video.
PSSE (Picture Spatial Scaleable Extension)	This is received when the spatial scalability of MPEG-2 video is used in the video stream.
PTSE (Picture Temporal Scaleable Extension)	This extension is received when the temporal scalability of MPEG-2 video is used in the video stream.
UD (User Data)	This displays any user data associated with the picture in hexadecimal format. If the data represents ASCII text, the ASCII text is also interpreted and displayed.
CPE (Camera Picture Extension)	

***NOTE**. These tabs will only operate if the appropriate extensions are present within the stream under test.*

All four matrices will only display if they are downloaded with certain stream types for example, HDTV streams.

- indicates that only the default matrix will be displayed.

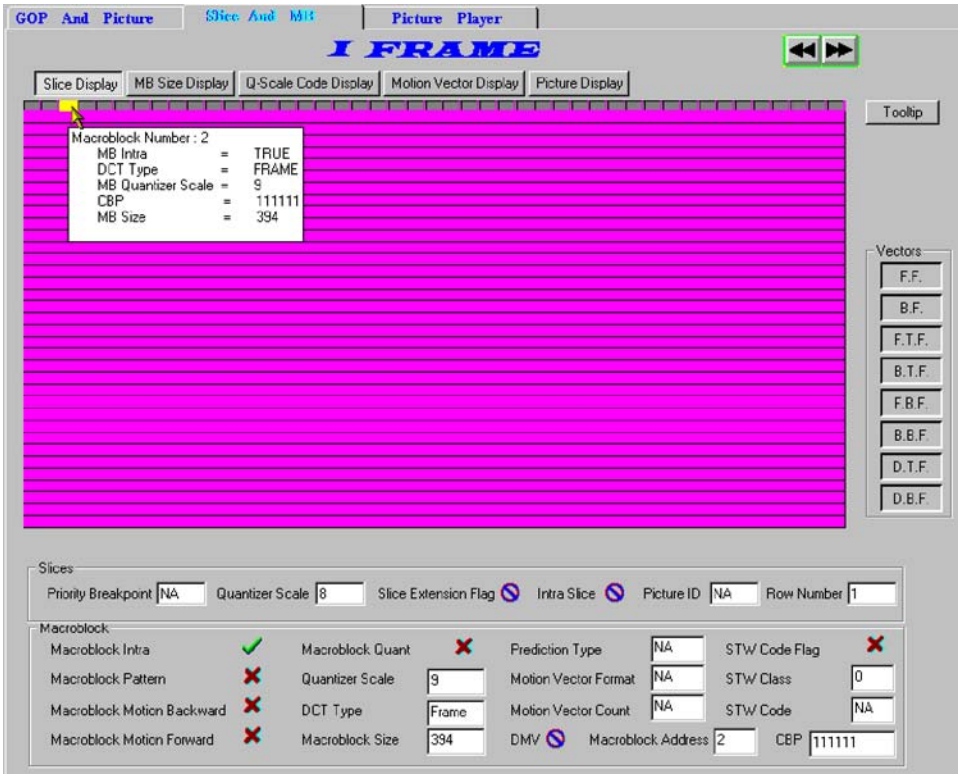
Displaying the Slice and Macroblock

ES Analyzer allows you to take a microscopic view of a picture by letting you view the picture's slice and macroblock structure.

To view slice details of any picture:

1. Select the picture by using the picture slider on the GOP And Picture tab.
2. Click the Slice and MB tab.

The macroblocks for the selected picture are displayed as shown below:



The Slice dialog box graphically displays the slices and macroblocks in the picture and also displays the:

- Slice header for the selected slice.
- Macroblock details for the selected macroblock.
- Picture Quality data, which overlaps the slice display area.
- Decoded field/frame for the selected picture.

Explaining the Slice and Macroblock Display

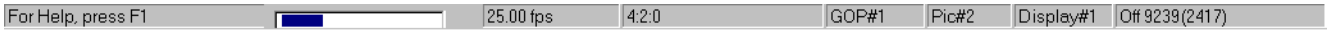
When displaying the slices, the current picture is represented by its constituent slices; see the above illustration. You can move the mouse to any slice and select it using the left mouse-button. The slice header display shows the header for the currently selected slice. MPEG-1 slices can span multiple rows and the display shows the same.

Slice display is color coded. Intra-slices are shown in green color, while slices that do not have this flag set are displayed in gray color.

Within a slice, the macroblocks are also shown. You can select a macroblock in the slice using the left mouse-button. The header and information of the currently selected macroblock is displayed below the macroblock display. Skipped macroblocks in a slice are shown using a different color and cannot be selected.

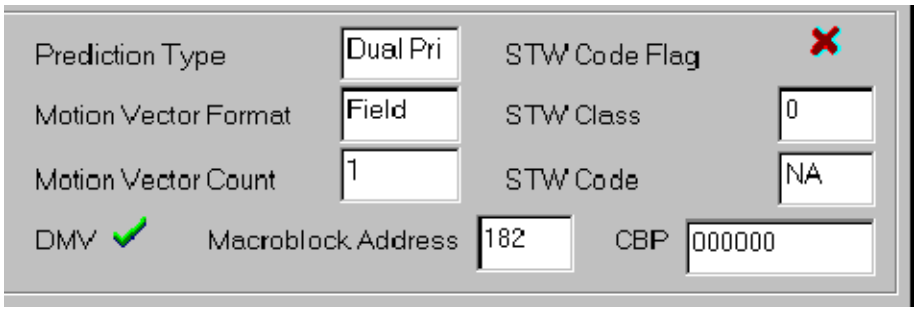
When viewing the slice display, you can move forward to the next picture or backward to the previous picture. You do this by clicking the picture navigation buttons on the top right corner of the dialog box. You can also return to the GOP display and select a specific picture. When moving backwards, you cannot cross the GOP boundary; however, when moving forward, you can cross a GOP boundary.

When displaying macroblocks, the status bar looks like this:



Viewing Coded Block Patterns for a Macroblock

While in the slice and macroblock level display, you can view the coded block pattern for any macroblock (except for the skipped macroblocks). This is displayed in the last field (CBP) as shown below.

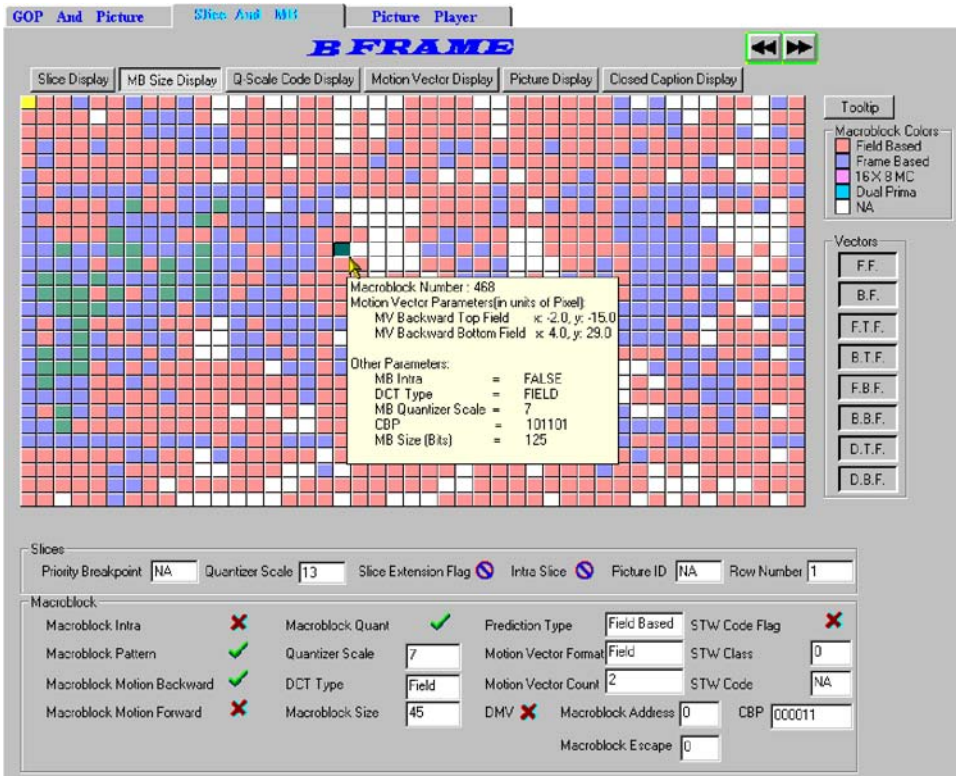


Depending on the chroma format, the coded block pattern is displayed as a sequence of 6, 8, or 12 bits. From left to right, the bit pattern represents the blocks in the macroblock as they are numbered in the standard MPEG specifications. For more details, see the ISO/IEC 11172-3 and ISO/IEC 11318-3 documents.

Analyzing Picture Quality

Viewing the Macroblock Size Spectrum

The Macroblock Size Display provides a color-mapped two-dimensional graphical plot of the macroblock size and type distribution in a picture; it is plotted as an overlay on the slice display area. This plot can be viewed by clicking on the MB Size Display button in the Slice and MB tab. The types of all macroblocks in the picture are color-mapped; a key is shown at the right side of the display and described below (see Macroblock Colors). Skipped macroblocks are displayed in dark green. The macroblock size for the selected macroblock is displayed in the macroblock field display area below it.



Macroblock Colors. The color-coded macroblock type represents the prediction type employed.

Field Based	Predictions are made independently for each field by using data from one or more previously decoded fields.
Frame Based	Predictions are made for the frame using the data from one or more previously decoded frames.

16 x 8 MC	(16 x 8 motion compensation) In which two motion vectors are used for each macroblock. The first motion vector is used for the upper 16x8 region, the second for the lower 16x8 region. In the case of a bi-directionally predicted macroblock a total of four motion vectors will be used since there will be two for forward prediction and two for the backward prediction. 16x8 MC is only used with field pictures.
Dual Prima	Only one motion vector is encoded (in its full format) in the bit stream together with a small differential motion vector. In the case of field pictures, two motion vectors are then derived from this information. These are used to form prediction from two reference fields (one top, one bottom) which are averaged to form the final prediction. In the case of frame pictures, this process is repeated for the two fields so that a total of four field predictions are made. This mode is only used in P-pictures where there are no B-pictures between the predicted and reference fields or frames.
NA	Not Applicable - Refers to the instances where there is no prediction in the macroblock.

(For more detailed information, refer to *ISO/IEC 13818-2 : 1996, Information Technology - Generic coding of moving pictures and associated audio information, Part 2 Video*.)

Viewing the Quantizer Scale Distribution

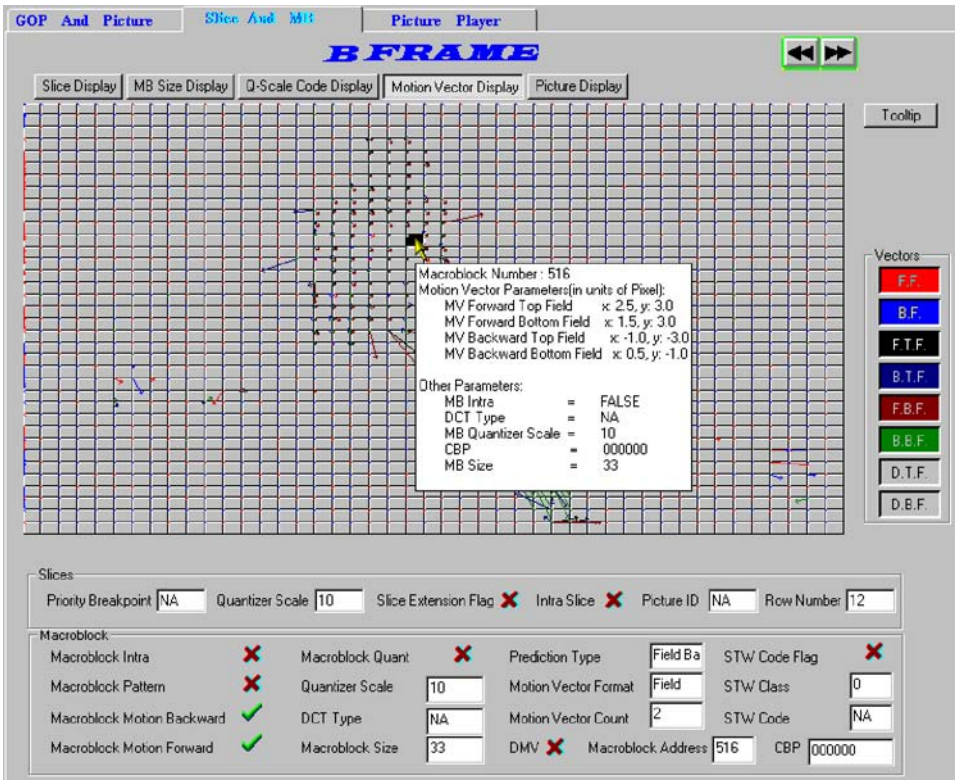
Quantizer scale distribution for the macroblocks in a picture is plotted where the picture slice is displayed. This gives you a graphical view of the scale code distribution and lets you visually check any obvious scale code problems. This plot can be viewed by clicking on the Q-Scale Code Display button in the Slices dialog box. The scale codes of 1 through 31 are mapped to shades of green with 1 being mapped to the lightest shade and 31 to the darkest (black). Skipped macroblocks use the same scheme but are mapped in shades of gray. The value of the scale code for the selected macroblock is displayed in the macroblock field display area below it.

Viewing the Motion Vector Plots

ES Analyzer gives a detailed graphical display of motion vector for the selected B or P picture. Both MPEG-1 and MPEG-2 type vectors are interpreted and displayed.

To view motion vectors (applicable to only B or P pictures).

1. Position the cursor to the picture for which you want to see the slice size plot.
2. Move into the slice display.
3. Click the Motion Vector Display button in the slice display dialog box.



For each macroblock, the motion vectors corresponding to it are plotted to scale as a directed arrow. The direction of the arrow represents motion coding for the macroblock from the reference frame to the current frame. Different types of vectors are plotted in different colors. You can also selectively choose to display different motion vectors by using the buttons on the right.

FF	Forward Frame		BF	Backward Frame
FTF	Forward Top Field		BTF	Backward Top Field
FBF	Forward Bottom Field		BBF	Backward Bottom Field
DTF	DMV Top Field		DBF	DMV Bottom Field

If a button is grayed out, the associated vector is not currently available.

The motion vectors are plotted for the luminance blocks. They are to scale (in the resolution of full pel or half pel) according to the pel resolution fields received. For each macroblock, multiple vectors may be received. All or some of them may be displayed simultaneously.

When Tooltips are enabled, a summary of parameters is displayed in a popup window.

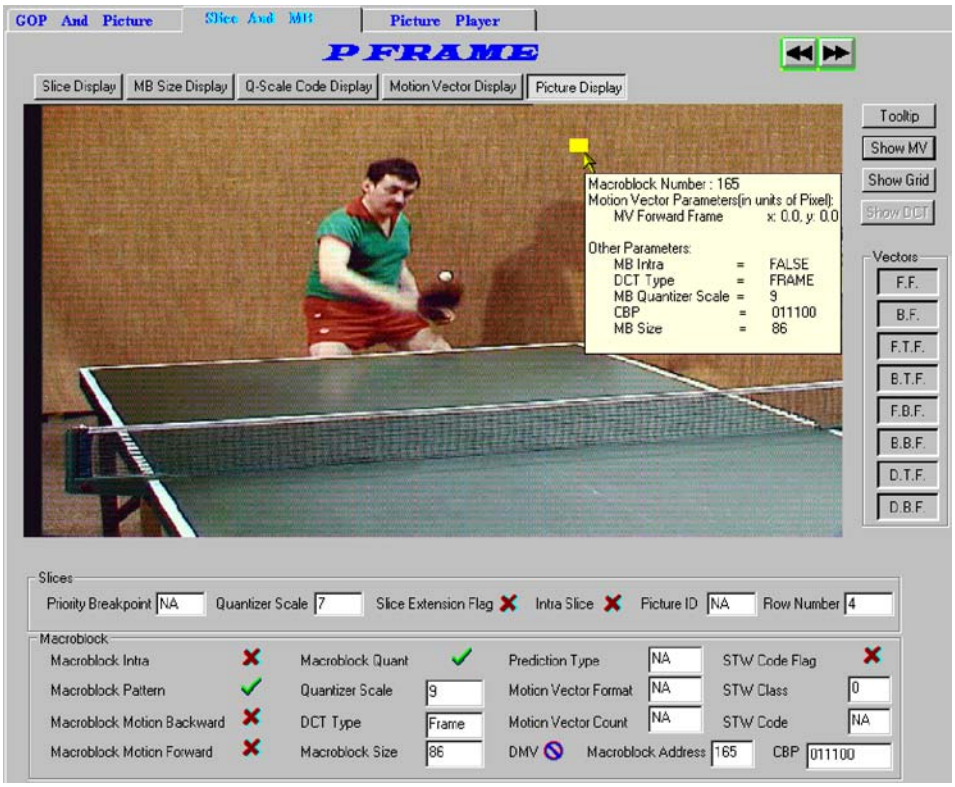
For MPEG-1 that has only frame pictures, two kinds of motion vectors are applicable -forward frame (for P and B pictures) and backward frame (for B pictures).

For MPEG-2 video, additional vectors may also be coded, which are: forward frame (for P and B pictures), backward frame (for B pictures), forward top field, backward top field, forward bottom field, backward bottom field, dual prime top field, dual prime bottom field.

ES Analyzer interprets all the above vectors and lets you view them graphically. When motion vectors cross the picture boundary, an error condition occurs and the same is reported in the error log window. In this case, the vector is drawn until the edge of the picture display.

Reviewing the Decoded Picture

ES Analyzer decodes and displays the selected picture when you click the Picture Display button. You can view I, B, or P frames or fields (only for MPEG-2).



ES Analyzer also allows you to view the previous and the next decoded picture (whether frame or field) by clicking the appropriate buttons. The actual size of the picture is displayed and if the picture is larger than the picture display area, scroll bars will appear. For the current picture being viewed, you can select a macroblock by clicking the left mouse button anywhere in the picture display area. When you do so, the slice and macroblock area below the picture displays the slice and MB data for the currently selected macroblock. If Tooltips are selected, a summary of the macroblock information is displayed in a popup box. When you switch from the picture display to the other picture-quality analysis tabs (e.g., MB Size Display, Q-Scale Code Display or Slice Display), the same macroblock remains selected for easy identification.

You can also enable a macroblock grid on the displayed picture by using the Show Grid button to easily identify and select macroblocks.

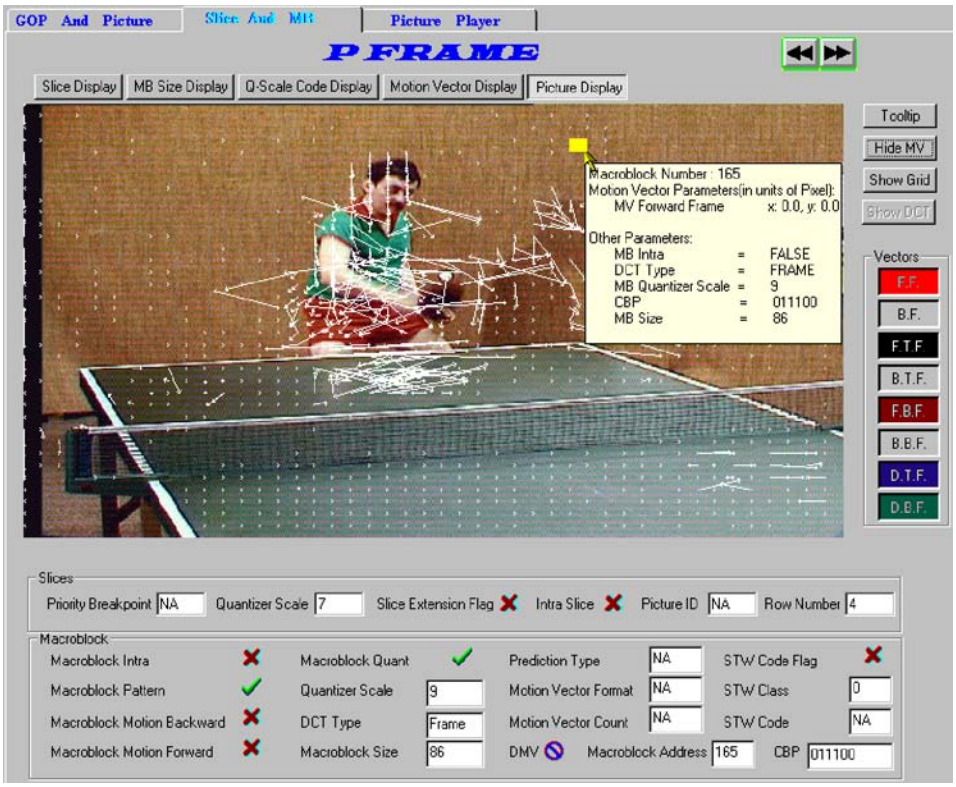
The picture display has the following limitations:

- When you navigate to a specific GOP using the toolbar icon, the picture display may be unable to display some B pictures correctly. These pictures are those that use a frame from the previous GOP for reference. This happens only when you navigate to a GOP that is not a closed GOP.
- For MPEG-2 scaleable streams, you will be able to display pictures only from the base layer. Other extension layer data cannot be displayed using ES Analyzer.
- ES Analyzer currently displays and decodes video streams within the following MPEG-2 profiles:
- Main Profile @ High Level (MP@HL)
- Main Profile @ Main Level (MP@ML)
- 4:2:2 Profile @ Main Level (4:2:2P@ML)

Viewing the Decoded Picture with Motion Vector Plots. The decoded picture can be further enhanced with an overlay of motion vector plots. The interpretation of the display corresponds with the description in the previous section - Viewing the Motion Vector Plots.

To view the vector plots for the currently displayed picture:

- Select the Show MV button on the right side of the picture.
- The vectors displayed will depend upon the selections made from the remaining buttons on the right side of the screen.



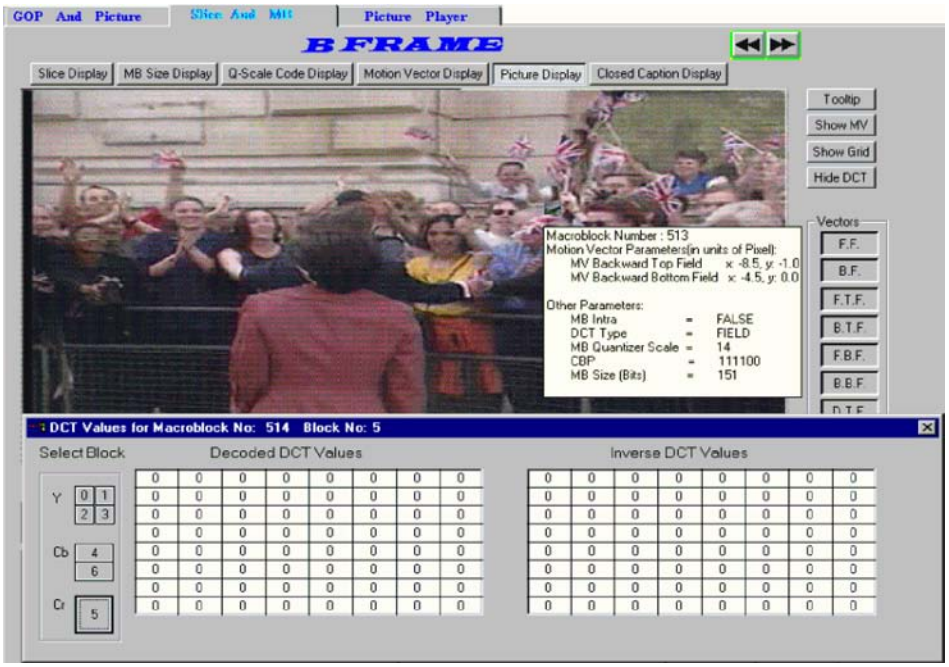
The picture display has the following limitations:

- When navigating to a specific GOP using the toolbar icon, the picture display may be unable to display some B pictures correctly. These pictures are those that use a frame from the previous GOP for reference. This happens only when you navigate to a GOP that is not a closed GOP.
- For MPEG2 scaleable streams, you will be able to display pictures only from the base layer. Other extension layer data cannot be displayed using ES Analyzer.

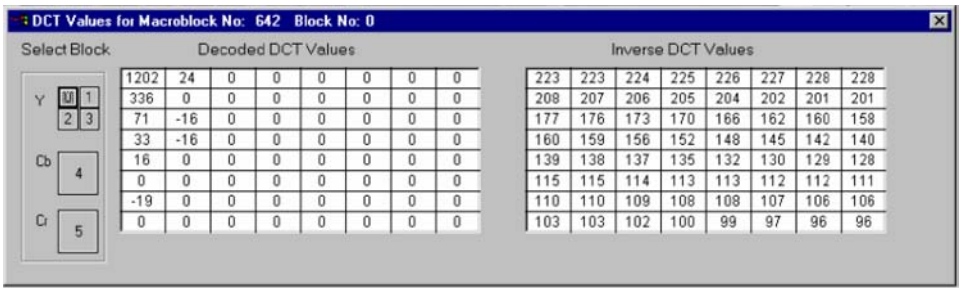
- For MPEG2 streams, ES Analyzer currently displays and decodes only decodes MP@HL, MP@ML, and 4:2:2 video streams.

***NOTE**. Make sure that your monitor's Display Properties is set to either 24 or 32-bit true color; otherwise, you may find a distortion in the colors in the picture being displayed.*

Displaying DCT Coefficients. The Discrete Cosine Transformation matrix of each block in a selected macroblock can be seen by selecting Settings > DCT Display from the Menu Bar. The DCT Display option is available only when viewing the details of GOP in Video Stream Analysis. Enabling the DCT Display option will enable Show DCT button next to the displayed picture in Slice & Macroblock Tab, Picture View Mode.



The Show DCT button is used to toggle the DCT Coefficients display. To view the DCT values of the a macroblock, select the macroblock; a window containing details of coded and decoded DCT values will be displayed.

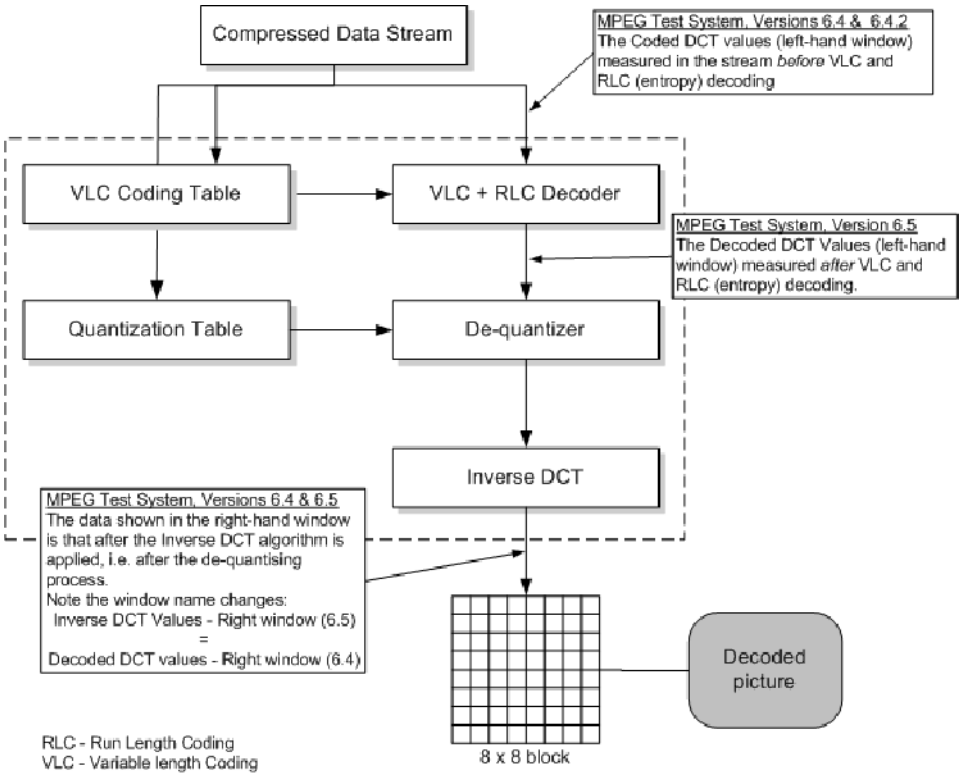


Note that the luma (y) control has four selections (0, 1, 2 and 3) which correspond to an 8x8 pixel corner of the 16x16 pixel selected macroblock. Chroma sub-sampling (Cb and Cr) will display matrices for the color differences between frames.

The picture display has the following limitations:

- When navigating to a specific GOP using the toolbar icon, the picture display may be unable to display some B pictures correctly. These pictures are those that use a frame from the previous GOP for reference. This happens only when you navigate to a GOP that is not a closed GOP.
- For MPEG2 scaleable streams, you will be able to display pictures only from the base layer. Other extension layer data cannot be displayed using ES Analyzer.
- For MPEG2 streams, ES Analyzer currently displays and decodes only decodes MP@HL, MP@ML, and 4:2:2 video streams.

DCT Value Display - Version Changes. The diagram below shows the monitoring points in the analysis process for the DCT values. The diagram also indicates the changes that occurred between ES Analyzer, Version 1.5 (MPEG Test System, Versions 6.4 and 6.4.2) and ES Analyzer, Version 1.6 (MPEG Test System, Version 6.5). The “windows” referred to are those in the DCT Values window.

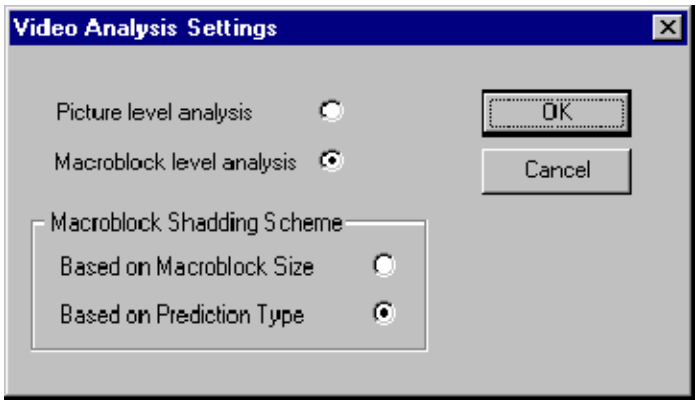

Compressed Data Stream
MPEG Test System, Versions 6.4 & 6.4.2
The Coded DCT values (left-hand window) measured in the stream *before* VLC and RLC (entropy) decoding
VLC Coding Table
VLC + RLC Decoder
MPEG Test System, Version 6.5
The Decoded DCT Values (left-hand window) measured *after* VLC and RLC (entropy) decoding.
Quantization Table
De-quantizer
Inverse DCT
MPEG Test System, Versions 6.4 & 6.5
The data shown in the right-hand window is that after the Inverse DCT algorithm is applied, i.e. after the de-quantising process.
Note the window name changes:
Inverse DCT Values - Right window (6.5)
=
Decoded DCT values - Right window (6.4)
Decoded picture
8 x 8 block
RLC - Run Length Coding
VLC - Variable length Coding

Configuring Video Analysis Settings

The video analysis or picture analysis default settings can be set as required.

***NOTE**. The selected Video Analysis settings will not affect analysis on either the Slice and Macroblock or the Picture Player pages. On the Slice and Macroblock page, analysis is always at the macroblock level. On the Picture Player page, analysis is always at the picture level.*

Video Analysis Settings. Select Settings > Video Analysis… from the Menu Bar. The following dialog box is displayed:



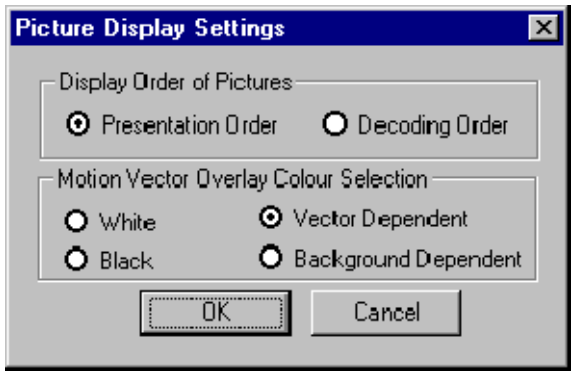
Select Picture level analysis to view frames quickly.

Select Macroblock level analysis if pictures/frames are to be analyzed at the macroblock level.

When Macroblock level analysis is enabled, select the shading scheme required.

Picture Display Settings. A number of display and vector parameters are set from the Picture Display Settings dialog.

Select Settings > Picture Display… from the Menu Bar. The following dialog is displayed:



Display Order of Pictures	Select Presentation Order or Decoding order
Motion Vector Overlay Colour Section	White: All vectors will be displayed in white. Black: All vectors will be displayed in black. Vector Dependent: Colors will correspond to the vector selection button colors. Background Dependent: Colors are combined with picture background to provide a contrast.

Viewing the Slice Size Distribution

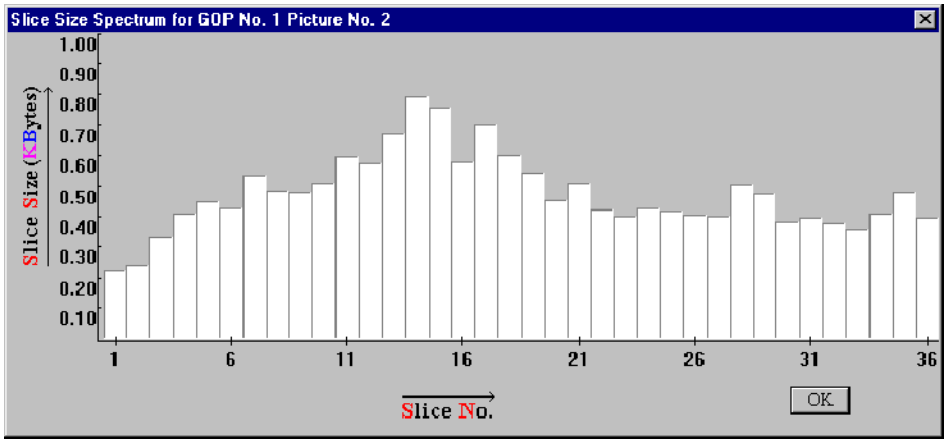
For any picture, you can also view the slice size distribution.

To view the plot.

1. Position the cursor to the picture for which you want to see the slice size plot on the GOP And Picture tab.
2. Move into the slices display by clicking the Slice and MB tab.
3. Click the Show Slice Size Statistics icon on the toolbar.

***NOTE**. The Show Slice Size Statistics icon is grayed out on all tabs except the Slice and MB tab.*

The plot appears in another window.



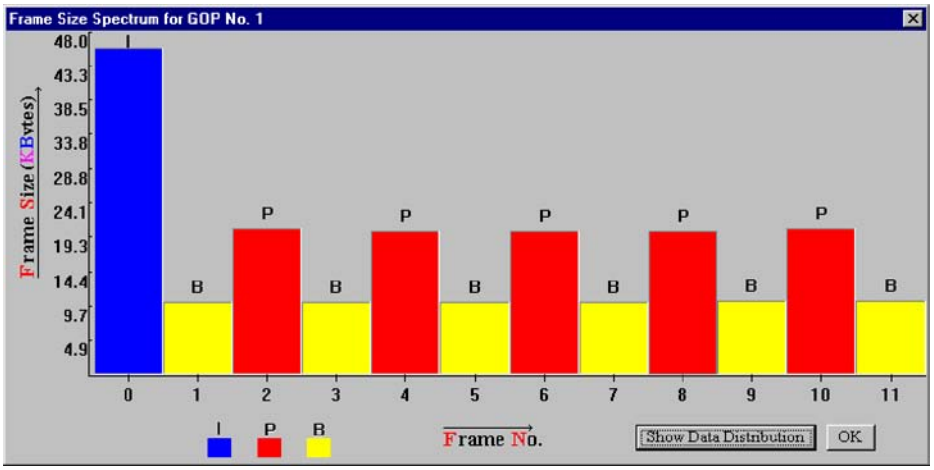
Viewing the Frame Size Spectrum

You can view the picture spectrum for a GOP and the frame size plots.

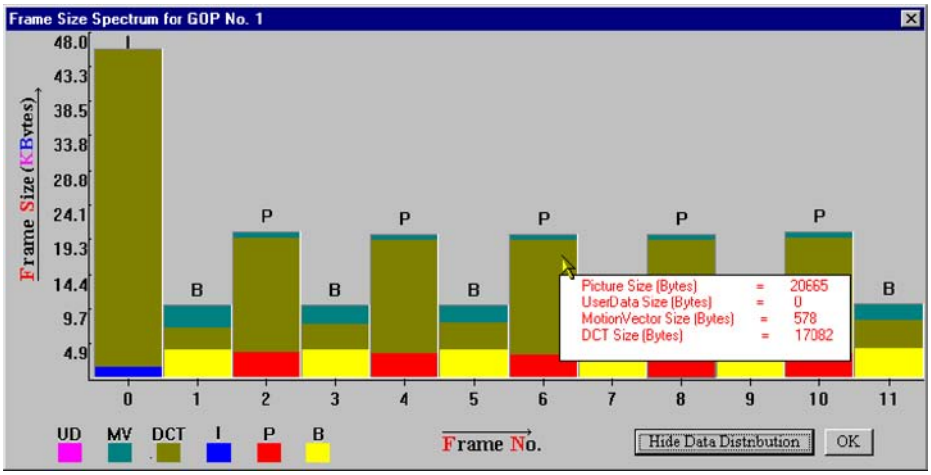
To view the plot..

1. Display the GOP for which you want to see the Frame Size Spectrum plot.
2. Click the Show Frame Size Statistics icon on the toolbar.

The following plot is displayed. Each bar represents the frame size in kilobytes:



Selecting the Show Data Distribution button will further enhance the plot by showing the content of each frame.



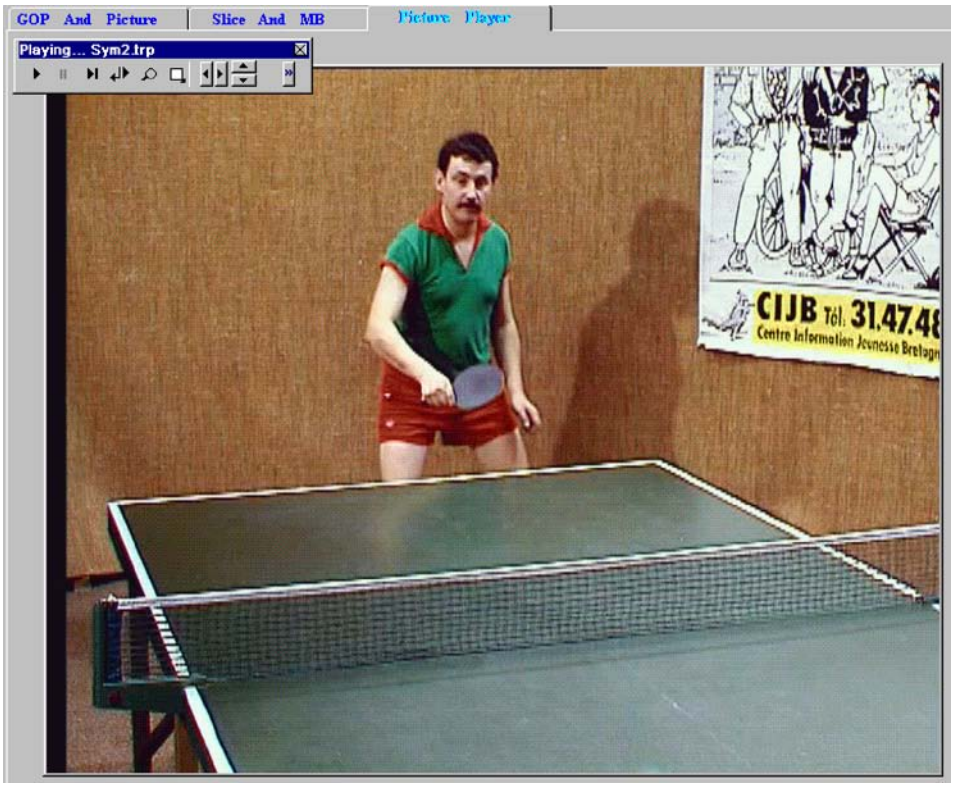
Content is color-coded as shown by the key in the bottom left corner. Details of the content of each frame are displayed when the cursor is moved over a frame.

Using the Video Viewer for Picture Analysis

The video viewer (or Picture Player) allows you to play a video stream and display the decoded picture on the screen. The picture player playback speed may vary from real time according to the ES Analyzer processor speed. You may also notice certain pauses in the display at regular intervals. These pauses occur at GOP boundaries. The Remote Control (described below) allows you to pause and resume the display at any frame. You can also restart the display from the beginning of the current GOP, or from the start of the video sequence.

The number of the current picture and the number of the last decoded picture are displayed, as shown in the following illustration. Here is a typical sequence of steps in which you may use the video viewer:

1. Open the video stream you want to analyze.
2. Start the video viewer.
3. Monitor the displayed picture for quality problems.



4. Pause the player whenever you notice a problem in a picture, such as a degradation in quality. The player is intentionally made to play at a speed slower than the regular play speed to allow you to stop at specific frames.

5. Switch to the analysis tabs to view details of the currently displayed picture down to the macroblock level.

6. Step forward or backward in decode order in the Slice And MB tab, or switch back to the video viewer and resume play.

ES Analyzer synchronizes the picture being currently displayed by the video viewer with the picture/data that is displayed on the other tabs: GOP And Picture and Slice And MB. This means that:

- The GOP And Picture and Slice And MB tabs always display data for the same picture.
- When you switch from the video viewer to either the GOP And Picture or the Slice And MB tab, you are presented the data for the picture being displayed on the Picture Player tab.
- When you switch from the GOP And Picture or the Slice And MB tab to the Picture Player tab, the video viewer presents the picture for the data being displayed on the GOP And Picture or the Slice And MB tab.
- If you select a macroblock and switch to the picture-quality analysis tabs (such as MB Size Display, Q-Scale Code Display or Slice Display), you will find that the same macroblock remains selected for easy identification.

The video viewer, however, has the following limitations:

- When you navigate to a specific GOP using the toolbar icon, the picture display may be unable to display some B pictures correctly. These pictures are those that use a frame from the previous GOP for reference. This happens only when you navigate to a GOP that is not a closed GOP.
- For MPEG-2 scaleable streams, you will be able to display pictures only from the base layer. Other extension layer data cannot be displayed using ES Analyzer.
- ES Analyzer currently displays and decodes video streams within the following MPEG-2 profiles:
  - Main Profile @ High Level (MP@HL)
  - Main Profile @ Main Level (MP@ML)
  - 4:2:2 Profile @ Main Level (4:2:2P@ML)

Picture Player Remote Control

The Remote Control is displayed whenever the Picture Player tab is selected.

	Play Video	Plays the video stream from where it last stopped.
	Stop	Stops the video stream and allows the other analysis tabs to be selected.
	Next Picture	Steps forward one frame.
	Play from GOP Start	Plays the pictures from the start of the current GOP.
	Zoom/Restore Display	Enlarges and restores the area in which the picture appears.
	Fit Best in Display Area/ Display Picture at True Size	Fits picture in display area or displays picture at original size.
	Left/Right Scroll	Scrolls the displayed picture left and right.
	Up/Down Scroll	Scrolls the displayed picture up and down.
	Show/Hide information	Shows or hides the information panel for the displayed picture. The following information is displayed: **GOP Number** - in which the frame is present. **Coded Number** - refers to the picture number within the GOP. **Display Time** - in hh:mm:ss:cc; where cc is the display number in the whole file. **Display Number** - refers to the display number of a picture within the GOP.

Working with Audio Streams

ES Analyzer analyzes both MPEG (-1 and -2) Audio streams and Dolby Digital (AC-3) Audio streams.

Understanding MPEG Audio Streams

An MPEG audio stream consists of a sequence of audio frames. Audio data may be received for multiple channels. Each channel is divided into sub-bands for which data is transmitted.

ES Analyzer verifies audio streams according to the MPEG audio recommendations. Support for both MPEG Layer I and Layer II audio is available. MPEG-2 extensions for Layer I and II (surround and center channels, and low frequency channels) are also interpreted and analyzed. Multi-lingual extensions in MPEG-2 are currently not analyzed. ES Analyzer is also unable to analyze the MPEG-2 Audio stream if the extension bit stream is present.

For a detailed discussion on the MPEG audio syntax, refer to ISO 11172-3 and ISO 13818-3.

With ES Analyzer, you can:

- Navigate to any audio frame; see details in the Navigating through Streams section in the Getting Started chapter.
- View frame details, including frame header, and plots of the frame data, as shown in the following illustration.
- Interpret and display audio descriptors received in higher level streams and validate them against the stream.
- Play an audio stream.

For each audio frame, data may be received for at most two channels, as shown in the next illustration; additional channels may also be received in the MPEG-2 extension.

Audio Player

The Audio Player is available on MPEG-1, MPEG-2 and Dolby AC-3 streams (and AAC as an option). With a suitable sound card installed in the host PC, audio streams can be played.

***NOTE**. The speed and quality of playout, isnot high fidelity, but is sufficient to allow an audio stream to be monitored for analysis.*

***WARNING.** While an audio stream is playing, you cannot access any other analyzer functions. In particular, do not close the Audio Player while an audio stream is playing (especially in loop mode), because you will be unable to reopen the player (and control the stream) until it has finished playing.*

If more than one audio device is installed, a selection can be made from the Device drop-down list.

The channels to be played can be selected from the Play Channels drop-down list.

To open the Audio Player, select the player start button, which is available on the audio stream header pages.

The Audio Player control panel is displayed:

The player controls follow the same convention as the Video Player controls:

- Play
- Stop
- Fast forward
- Fast rewind

(To use Fast Forward and Fast Rewind, press the required button and then stop the action with the Stop button.)

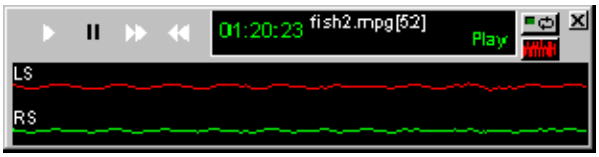
The Audio Player display shows the following:

- Play time
- Stream Name and Audio PID number
- Player status (Stop/Play)

The following controls are available in addition to those described in the preceding list.

Toggles continuous (or looped) playout.

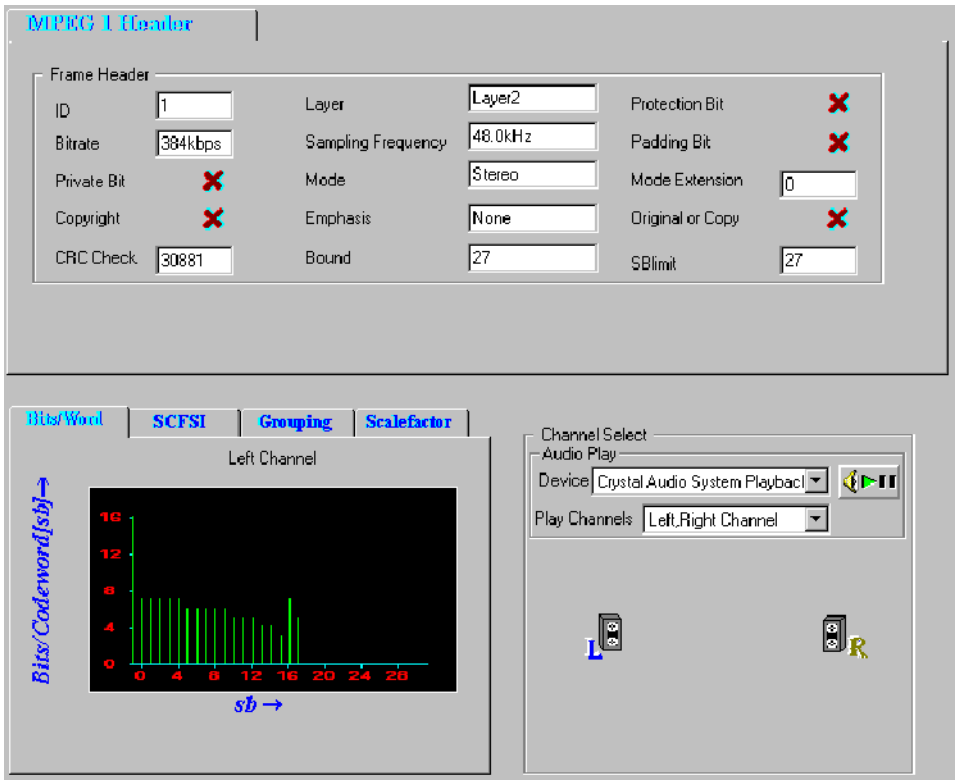
Toggles a real-time waveform display.



***NOTE**. Currently two channels are output to the sound card. These can be assigned as required (as mono or stereo) from any of up to five channels in a stream.*

Explaining MPEG-1 Audio Streams

ES Analyzer displays data for each channel separately.



For the selected audio frame, ES Analyzer displays the following:

- The frame header.
- A plot of bits per code word against the sub-bands for each channel.
- SCFSI (Scale Factor Selection Information) plotted against sub-band for each channel.
- Grouping information plotted against sub-bands for each channel.
- The scale factor plotted against the sub-band.
- Channel selection and playout controls.

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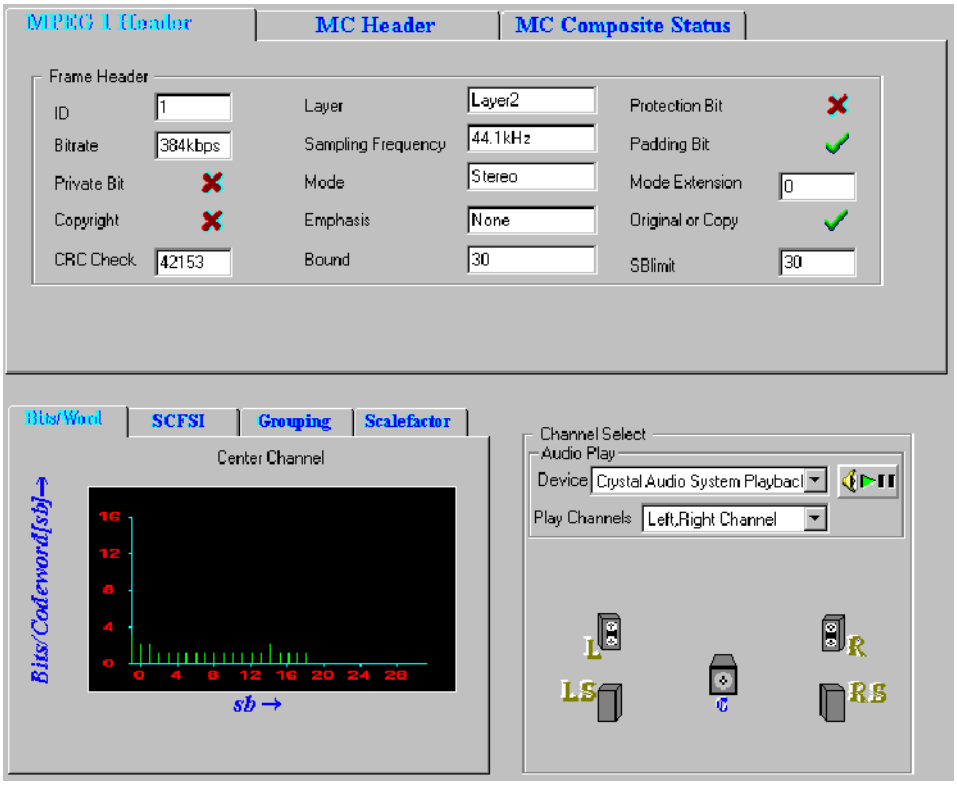
Explaining MPEG-2 Audio Streams

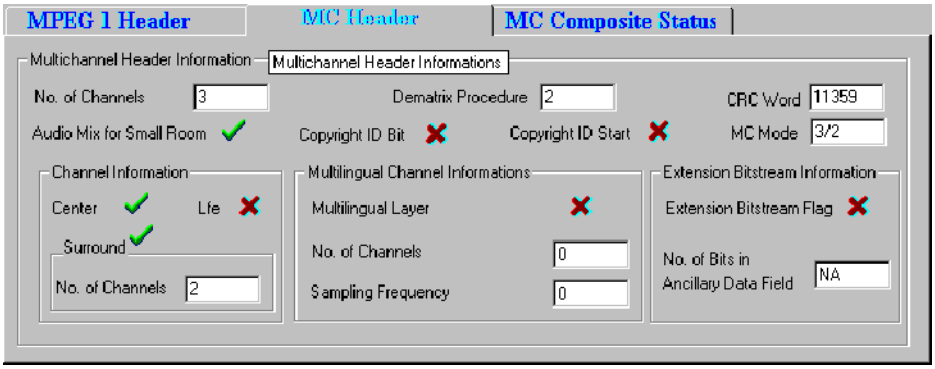
For MPEG-2 Audio streams, ES Analyzer analyzes the following channels if the data is present: Left, Right, Left Surround, Right Surround, Center and LFE. Currently, ES Analyzer analyzes 5.1 Audio streams. When ES Analyzer detects an MPEG-2 Audio stream, the information displayed is similar to what is shown in the following illustration.



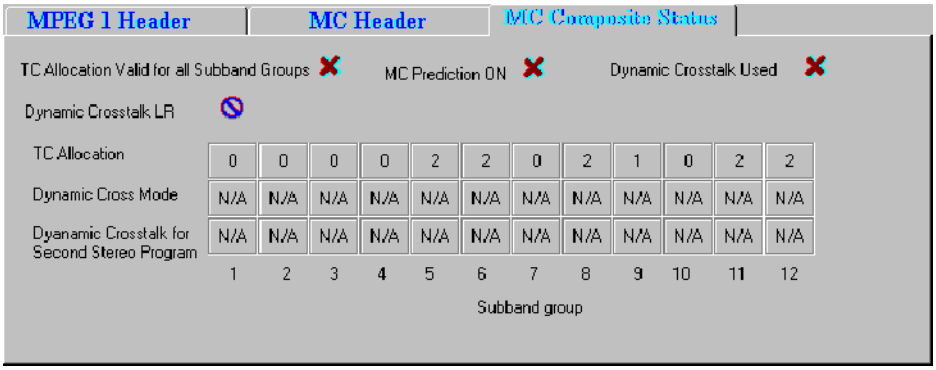
ES Analyzer displays information on the following tabs: MPEG-1 Header, MC Header (Multi-channel header), and MC Composite Status (Multi-channel composite status).

MPEG-2 Audio streams are backward compatible with MPEG-1 streams. Therefore, the MPEG-1 header for each frame is the same as that for an MPEG-2 Audio stream.

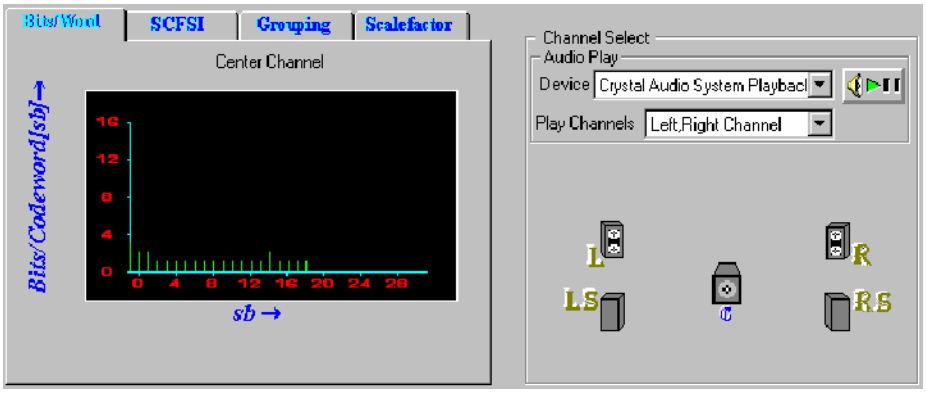
The MC Header tab displays information about the additional data present for the multi-channel extensions, over the two stereo channels. It gives you the number of channels that are present, the presence of the LFE channel, additional CRCs, and other relevant fields in the MC Header, as shown.



The MC Composite Status tab provides the sub-band information of the channels; and their relationship with the transmission channels, as shown.


MPEG 1 Header
MC Header
MC Composite Status
TC Allocation Valid for all Subband Groups
MC Prediction ON
Dynamic Crosstalk Used
Dynamic Crosstalk LR
TC Allocation
0 0 0 0 2 2 0 2 1 0 2 2
Dynamic Cross Mode
N/A N/A N/A N/A N/A N/A N/A N/A N/A N/A N/A N/A
Dyanamic Crosstalk for Second Stereo Program
N/A N/A N/A N/A N/A N/A N/A N/A N/A N/A N/A N/A
1 2 3 4 5 6 7 8 9 10 11 12
Subband group

The lower part of the dialog box displays information specific to the channels. You can select the channel for which you want to see the details by clicking the appropriate graphic at right. The channel-specific data for the selected channel is displayed at left as for MPEG-1.



Explaining the Status Bar Display

The status bar for Audio streams displays the following:

- Frame number, which is the number of the current frame in the stream.
- Layer number, which is the number of the audio stream.
- Byte offset in the file, which is the first byte of the Frame header being currently viewed in both the hexadecimal and decimal formats.

Understanding Dolby Digital (AC-3) Audio Streams

ES Analyzer also analyzes Dolby Digital's audio streams, which could be an independent, stand-alone audio stream, or a multiplexed stream that is embedded inside an MPEG-2 System stream (ATSC transport or program stream). The Dolby Digital stream is analyzed by ES Analyzer for syntactic compliance with Dolby Digital specifications.

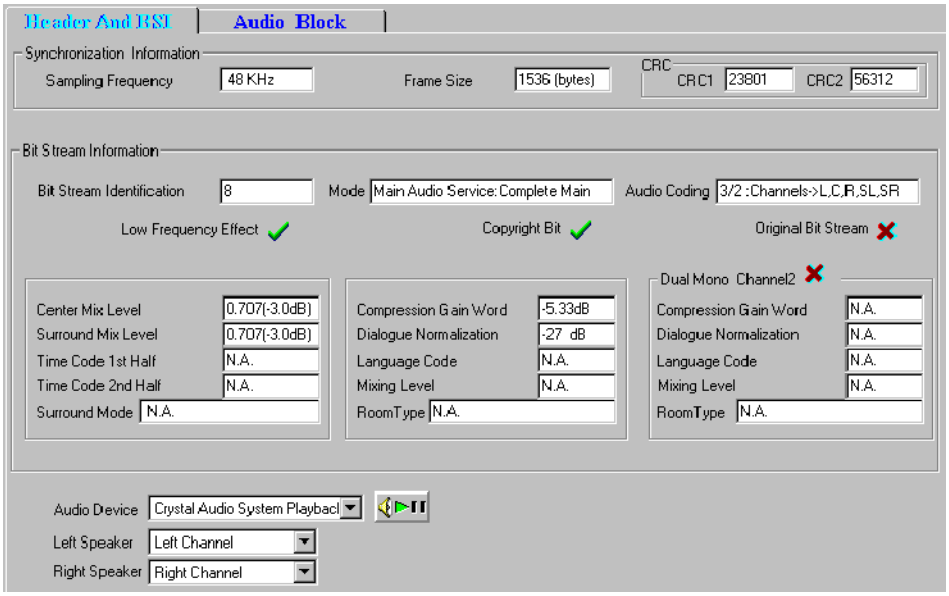
For a detailed discussion on the Dolby Digital audio syntax, refer to the document A/52 from Advance Television Systems Committee (ATSC).

ES Analyzer analyzes Dolby Digital stream frame by frame and also performs CRC checks for each audio frame. When analyzing a Dolby Digital stream, you may navigate to any frame and also view data specific to an audio block within it.

Automatically detecting the data format used in the Dolby Digital stream, ES Analyzer analyzes both the little endian and the big endian formats. For ease of debugging, ES Analyzer displays information for all the fields of any block for any audio frame.

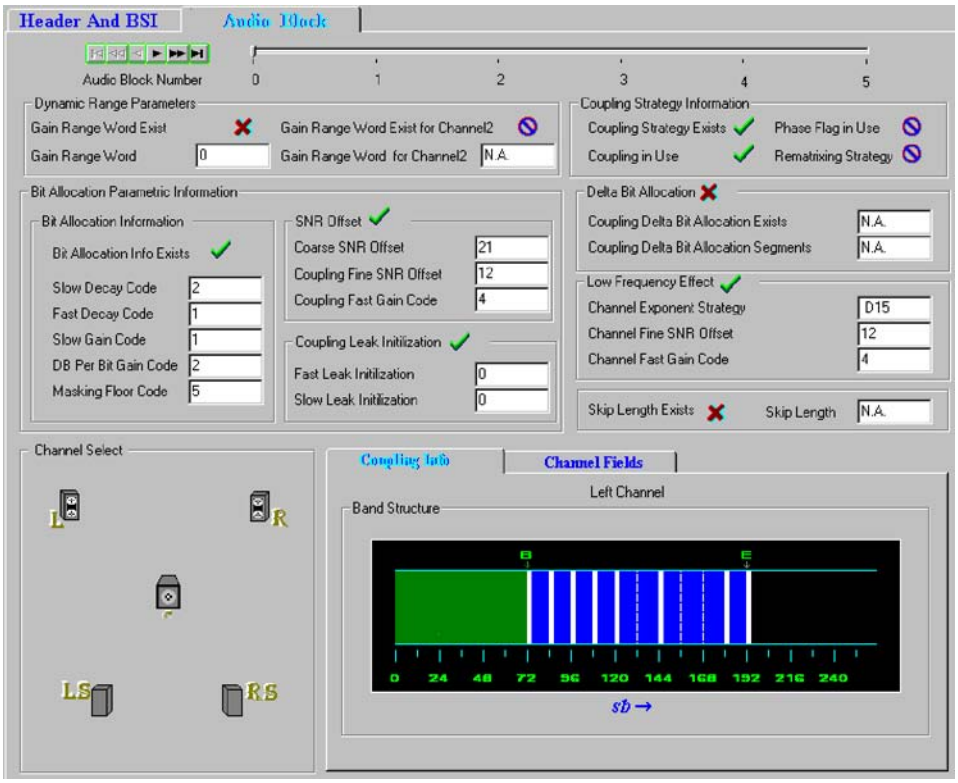
When errors are encountered in a stream, ES Analyzer reports the errors and synchronizes to the next audio frame to continue the analysis.

ES Analyzer displays the header and audio block information on specific tabs, as shown. The Header And BSI tab displays the Dolby Digital synchronization and bit stream information.

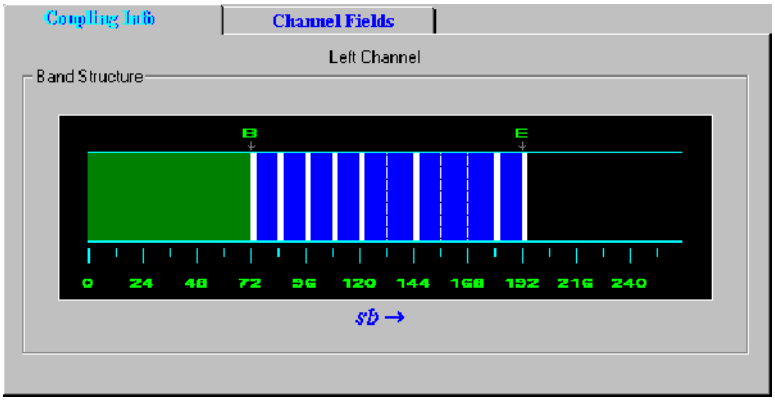


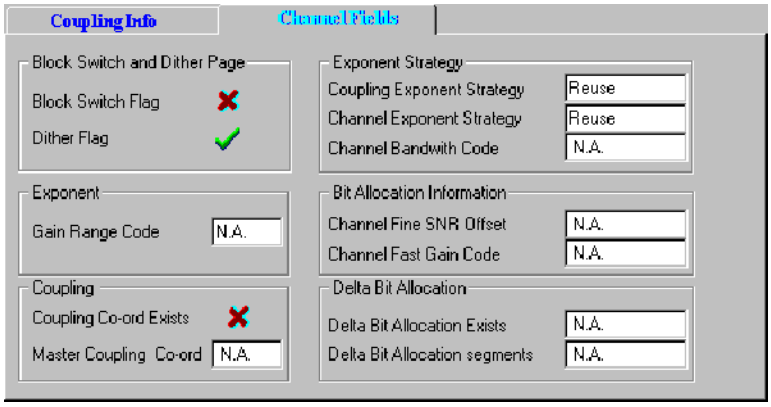
The audio controls are only available on the Header and BSI tab.

Depending on the selection, the Audio Block tab displays information for the corresponding audio block within the frame.



The lower part of the previous illustration displays the channel-specific information for the selected audio block, as shown in the following illustration.





The Coupling information tab distinguishes between the stand-alone and coupled data for the selected channel. The green band denotes the stand-alone information, and the blue region denotes the coupled information. The blue region may be further divided into bands; these appear as solid lines as opposed to the dotted lines that denote sub-bands.

Explaining the Status Bar Display

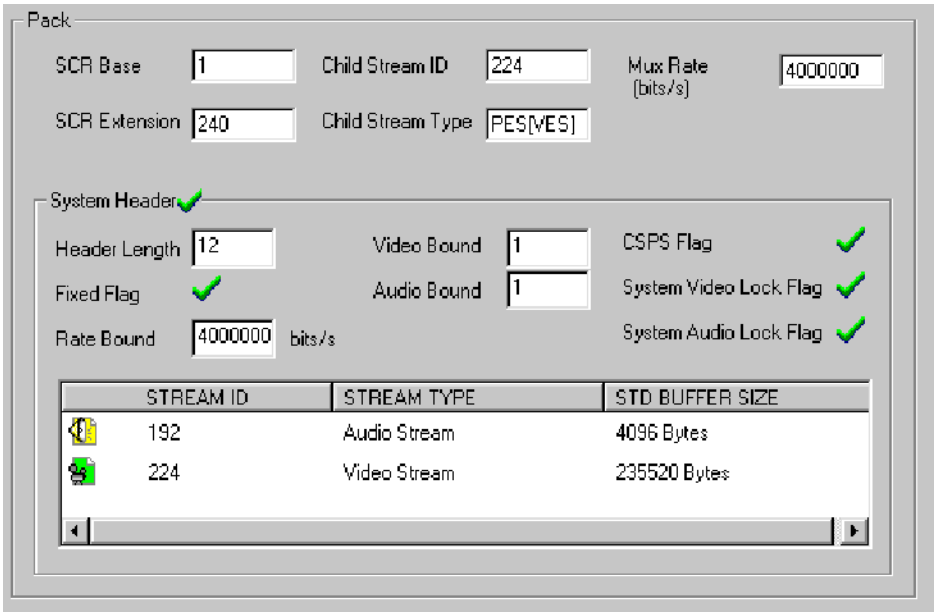
The status bar for Dolby Digital Audio streams displays the following:

- Frame number, which is the number of the current frame in the stream.
- Bit rate of the Dolby Digital audio stream.
- Sampling rate.
- Frame size information.
- Byte offset in the file, which is the first byte of the Frame header being currently viewed in both the hexadecimal and decimal formats.

Working with Program Streams

Program streams are quite similar to MPEG1 System streams in structure. A Program stream consists of a sequence of packs. Each pack has a header, an optional system header, and any number of packets. If a system header is not received in a pack, then the last received header is applicable for the pack. The system header is sent periodically in the stream to facilitate random access. Each pack contains any number of packets. Each packet belongs to a particular stream and has a PID associated with it. If packets of a given PID are concatenated, you get the embedded PES stream with this PID. The PES stream in turn has an elementary stream embedded in it.

For more details on Program streams, refer to the ISO/IEC 13818-1 document.



ES Analyzer performs conformance and semantic checks at the program stream packet level as per the ISO/IEC 13818-1 recommendations. An embedded stream is checked when you navigate through one; for details, see the Navigating through Streams section in the Getting Started chapter.

For Program streams, you can:

- View pack and system headers, as shown in the previous illustration.
- View the program stream map; see the *Viewing Program Map* section for details.
- View an embedded stream at the PES or the elementary stream level; see the Understanding Packetized Elementary Streams section for details.
- Perform buffer analysis of the embedded audio/video stream using the STD model; see the Analyzing Streams chapter for details.
- Perform PCR/PTS frequency analysis model; see the Analyzing Streams chapter for details.

Viewing Pack and System Headers

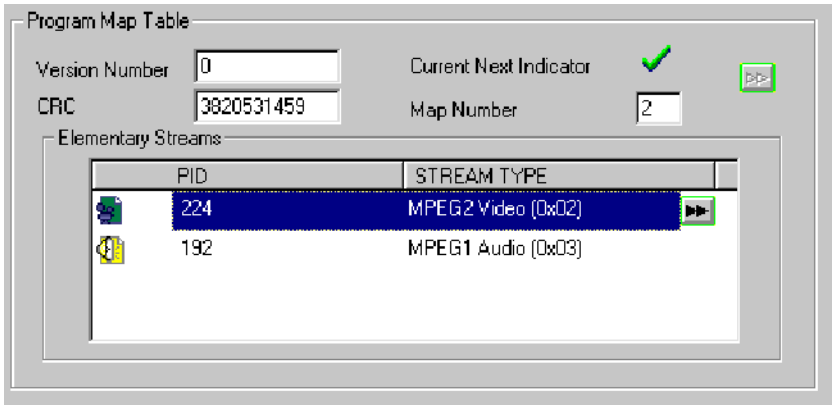
When navigating through a stream, the current pack is displayed in the header display area, as shown in the preceding illustration. The pack and system header fields are displayed for the current packet of the Program stream. The currently applicable system header is displayed for the packet. The receipt of a system header in the current pack is indicated by a check mark in the system header group box. A cross mark indicates that the system header was received earlier.

The list of streams declared in the header is displayed in the elementary stream list box. It is possible that the stream may contain some PES streams that are not declared in the System Header. Such streams are added in the tree view when a packet of the same is encountered.

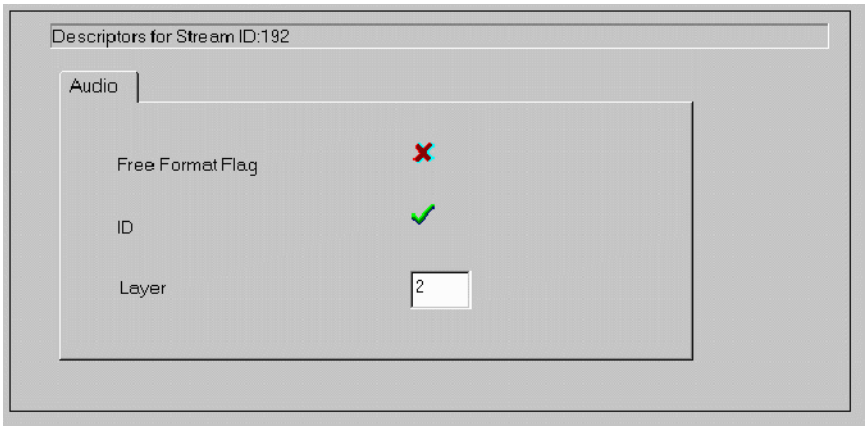
Viewing the Program Stream Map

The program stream map can be viewed by clicking the stream map icon (PSMAP) in the tree view window. This pops up the stream map showing the descriptors for the Program stream and the contained elementary streams. The descriptors associated with each elementary stream in a program can be viewed in one of two ways:

- By double-clicking the corresponding icon for the stream in the display
- By clicking the more details icon shown for the corresponding stream in the elementary stream listbox



The form is extended (if not already extended) to add the descriptors display, as shown in the following illustrations. All descriptors that are received for the corresponding stream are displayed on tabbed folders. If a descriptor is not received, its tab will not appear in the descriptor display. The illustrations below show descriptors for the respective video and audio tabs.



Explaining the Status Bar Display

The status bar for Program streams displays the following:

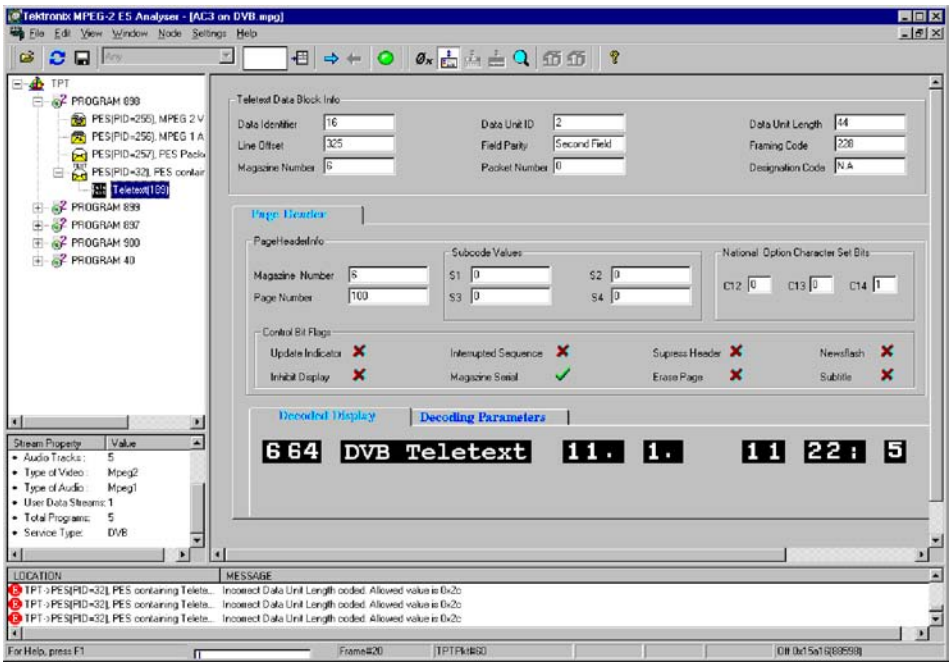
- Pack number, which is the number of the displayed packet.
- Packet number, which is the number of the current packet in the entire stream.
- Packet number of SID, which is the number of the current packet taking into account only packets of the same stream ID (SID).
- At GOP level, the location of GOP header/start at PES level and Pack level is displayed by PES packet number & Pack number respectively.
- At AES & AC3 level, the location of frame header/start at PES level and Pack level is displayed by PES packet number and Pack number respectively.
- Byte offset in the file, which is the first byte of the Pack header being currently viewed in both the hexadecimal and decimal formats.

Working with Teletext

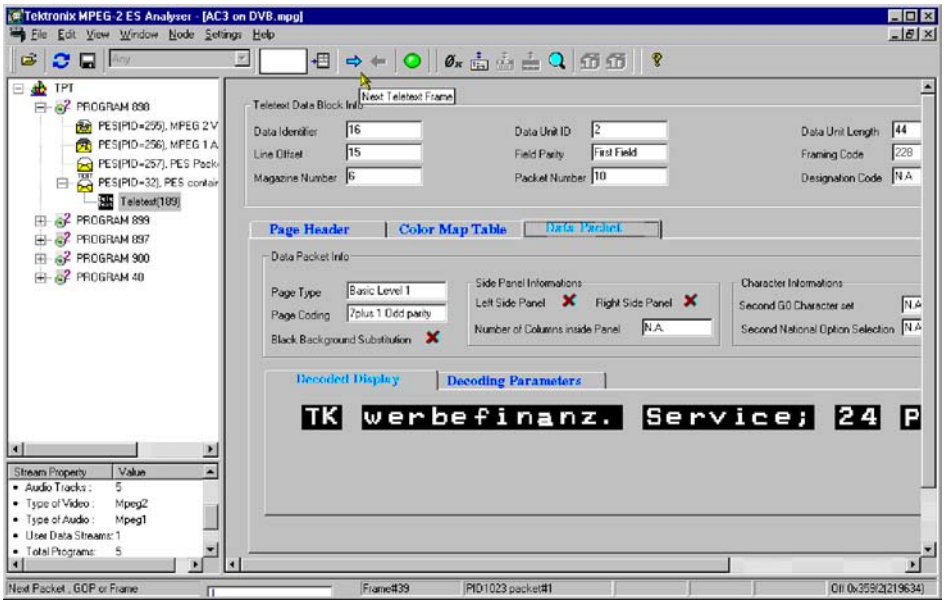
Teletext can be incorporated into DVB streams. ES Analyzer allows the associated data to be analyzed and viewed.

To view the teletext data, navigate to the teletext icon in the Tree View window.

Initially, the Page Header data will be displayed:



Using the Next button, details of the page can be viewed in the Data Packet tab.



Other tab pages (Color Map Table, Decoded Display, Decoding Parameters) provide detailed teletext encoding data. These tabs will only appear as progress is made through the stream using the Next button and the analyzer detects them.

VBI (Enhanced Teletext Support)

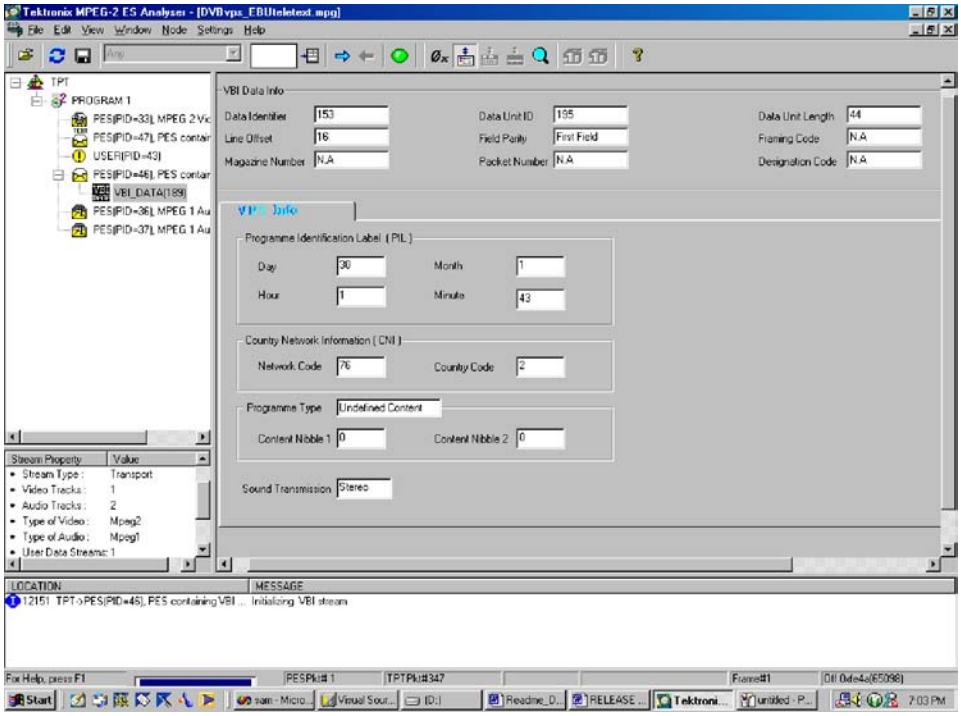
Enhanced teletext support is available (reference: ETSI EN 301-775). The supported extensions include the following:

- VPS (Video Program System)
- WSS (Wide Screen Signaling)
- Monochrome Data

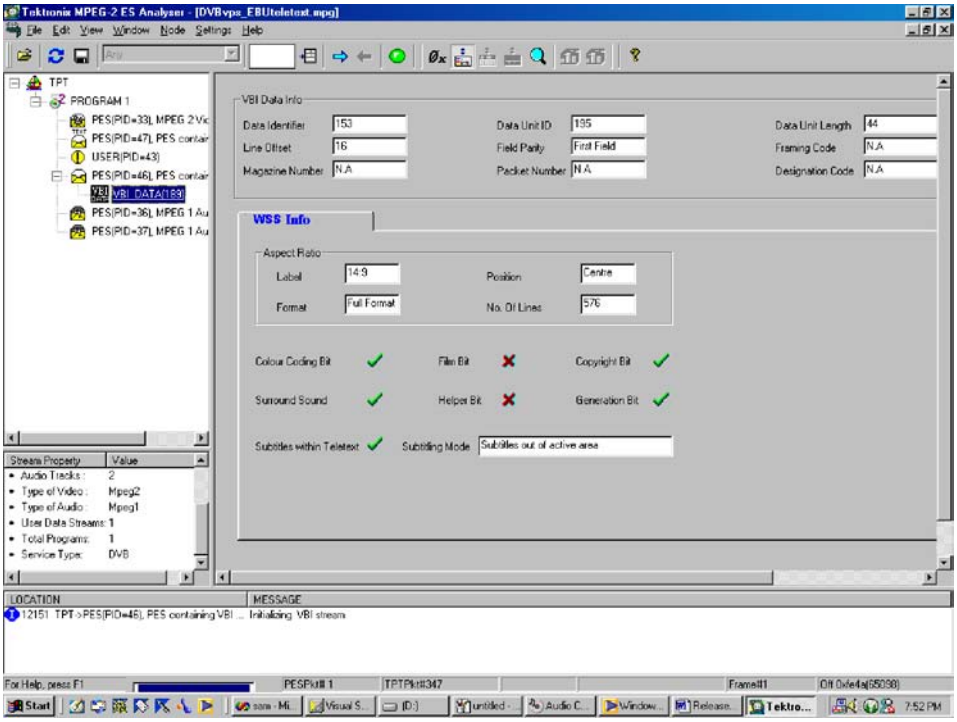
Note that the associated information screens will only be available for display where data of the specific type is available in the stream.

Examples of the screens are shown in the following illustrations.

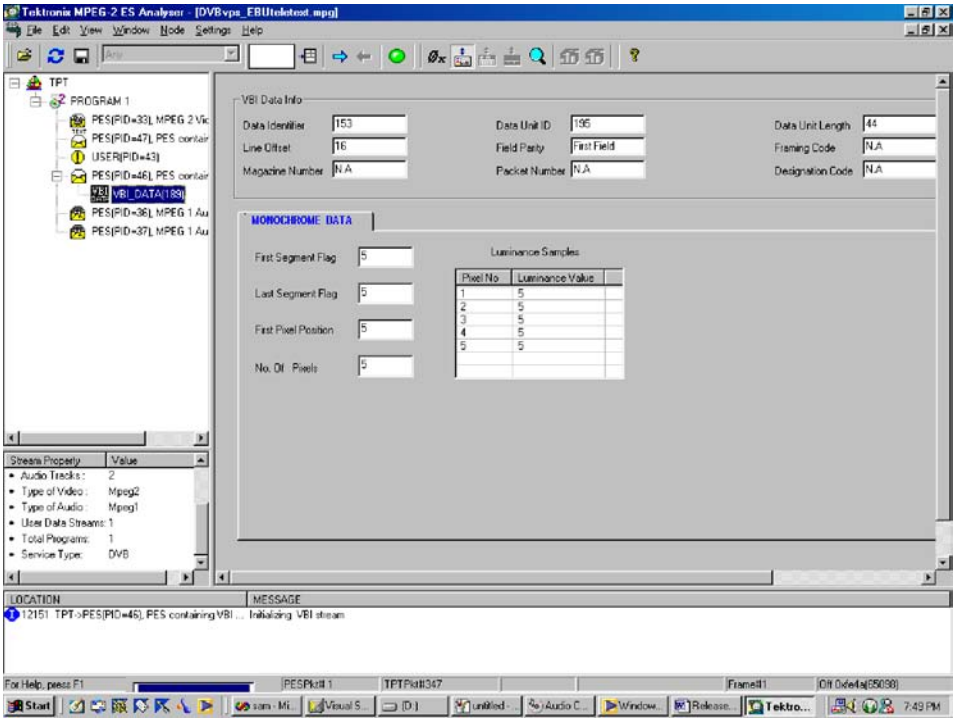
VPS (Video Program System)



WSS (Wide Screen Signaling)



Monochrome Data



Advanced Audio Compression

Elementary Stream Analyzer (ES Analyzer) performs off-line stored stream analysis for MPEG1 Audio, MPEG2 Audio, and Dolby Digital Audio streams, as well as MPEG1 and MPEG2 video streams. The streams can embedded inside DVB, ATSC or MPEG1 System streams.

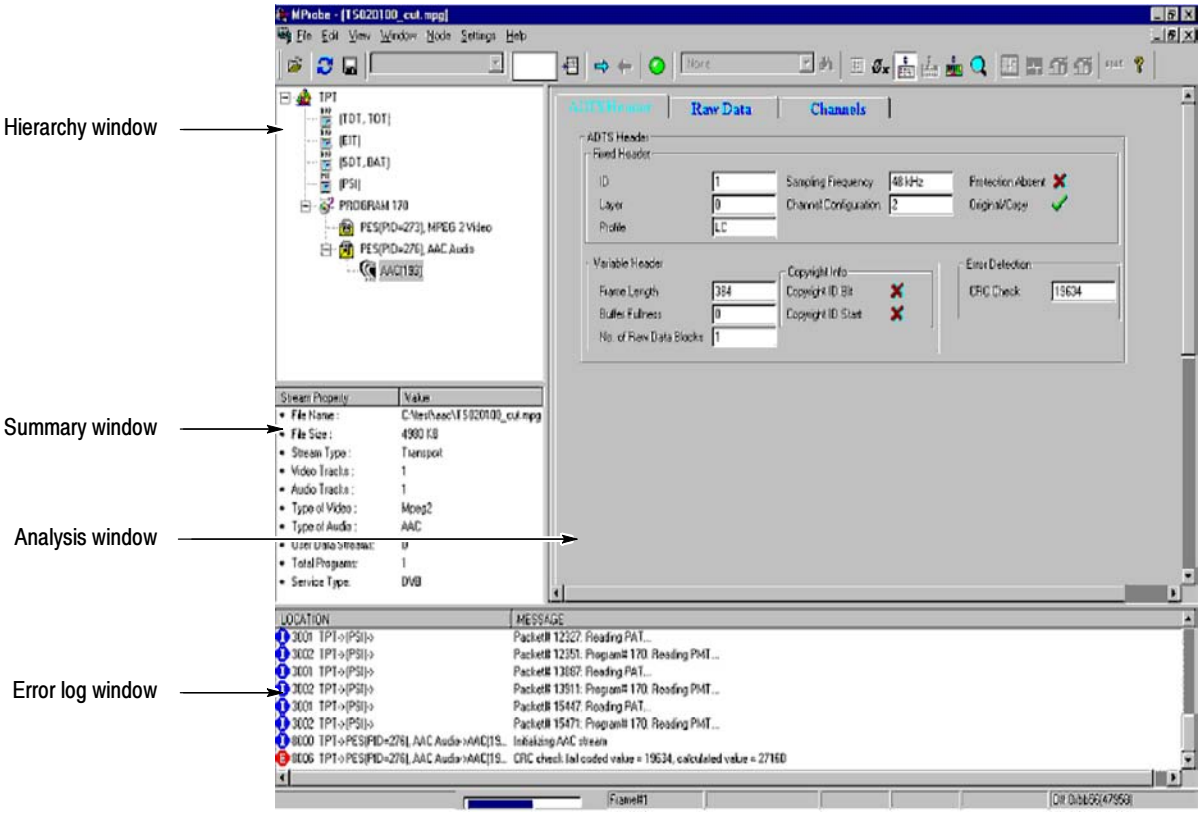
Advanced Audio Compression (AAC) is one of the audio compression formats defined by the MPEG-2 standard. AAC used to be called NBC (Non-Backward-Compatible), because it is not compatible with the MPEG-1 audio formats. AAC offers a better compression ratio than MP3 (MPEG-1 Layer 3) and is the state-of-the-art in audio compression technology. It can include up to 48 audio channels, 15 low frequency enhancement channels, 15 embedded data streams and has multi-language capability. MPEG formal listening tests have demonstrated that it can provide slightly better audio quality at 96 kb/s than layer-3 at 128 kb/s or layer-2 at 192 kb/s.

Due to its high coding efficiency, AAC is a prime candidate for any digital broadcasting system. The Japanese authorities were the first to decide to use AAC within practically all-digital audio broadcasting schemes. Because their first services will start in the year 2000, this decision has already triggered the development of dedicated AAC decoder chips at a number of manufacturers. Due to its superior performance, AAC will also play a major role for the delivery of high-quality music via the Internet. Furthermore, AAC (with some modifications) is the only high-quality audio-coding scheme used within the MPEG-4 standard.

The AAC bit stream is encoded in either of two formats:

- Audio Data Interchange Format (ADIF)
- Audio Data Transport Stream Frame (ADTS)

The corresponding forms are displayed according to the format of the input bit stream These forms display the information contained in the fields of the Header and the Raw Data.



ADIF Stream Forms

The analyzed information regarding the input ADIF stream is displayed by means of a property sheet containing three tabs.

The ‘ADIF Header’ tab (Figure 5-1) displays the fields of the header.

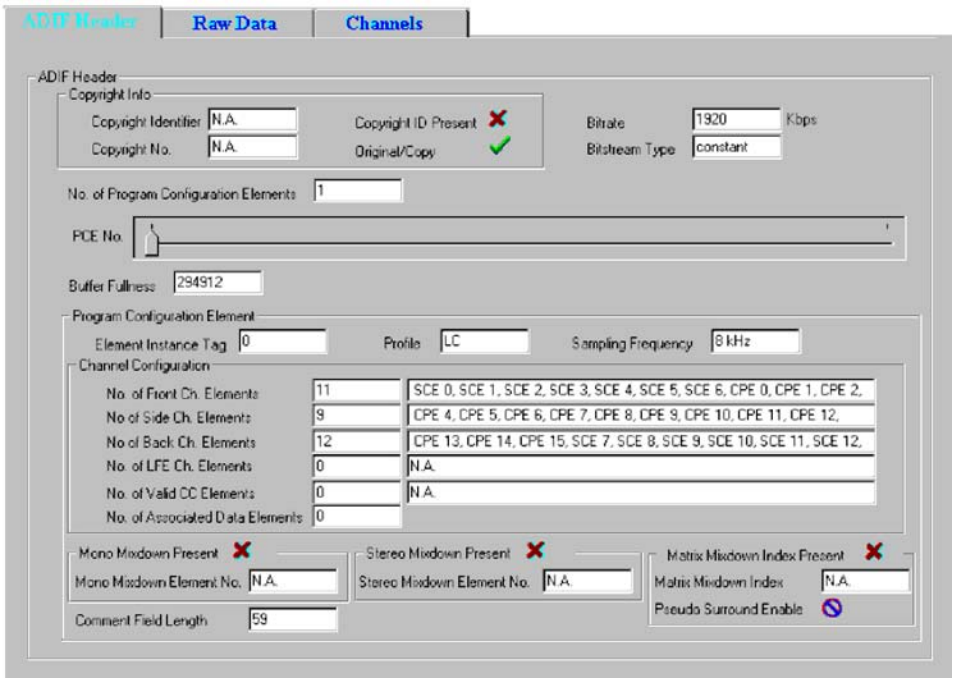


Figure 5-1: ADIF header Information

The ‘Raw Data’ tab (Figure 5-2) displays the fields in each raw data block. A slider control helps to navigate through the various raw data blocks. The information regarding each raw data block is displayed by means of another child property sheet containing seven tabs (the fields in each tab are shown in Figure 5-3 to Figure 5-9).

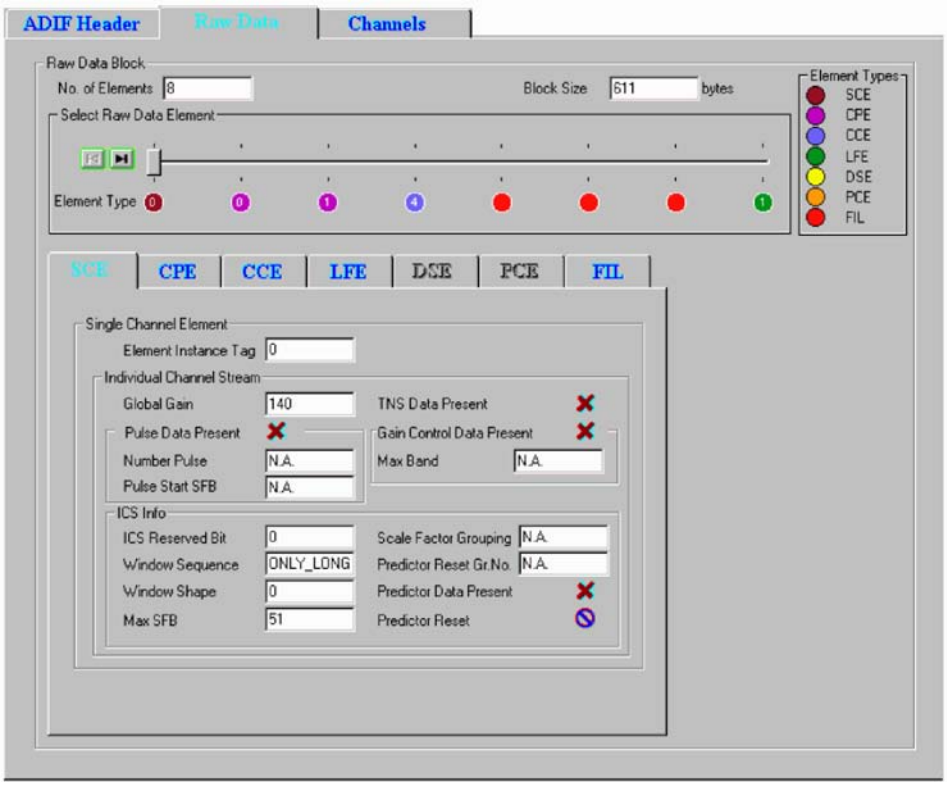


Figure 5-2: ADIF raw data Information

Element Color Coding in the Raw Data Tab

The Element Type (below the slider bar) is color-coded; the key is given on the right side of the display in the Element Types box. The number displayed in the Element Type color spot indicates the EIT (element instance tag) of that syntactic element.

Color Coding of Raw Data Tabs

The text in the Raw Data tabs is color-coded as follows:

Light Blue	indicates the syntactic element is present and activated in the raw data.
Dark Blue	indicates that the syntactic element is present, but currently inactive in the raw data.
Dark Gray	indicates that the syntactic element is not present in the raw data.

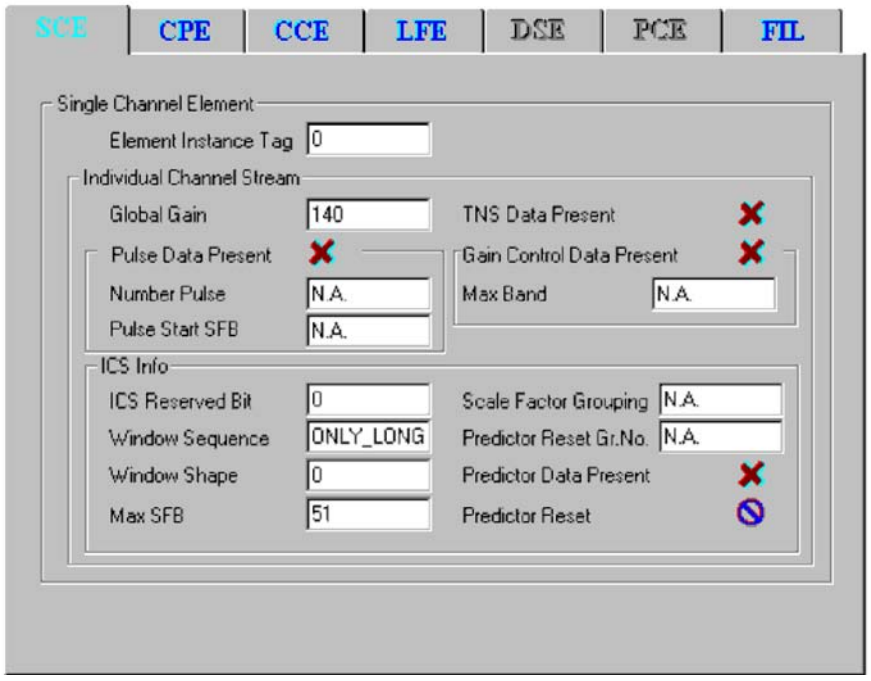


Figure 5-3: Single channel element Information

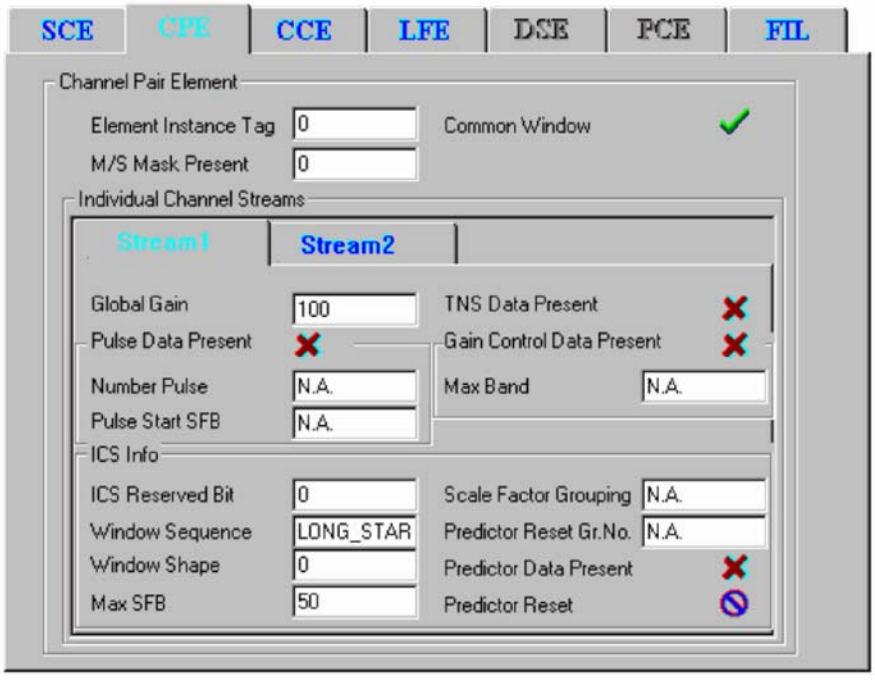


Figure 5-4: Coupling pair element information

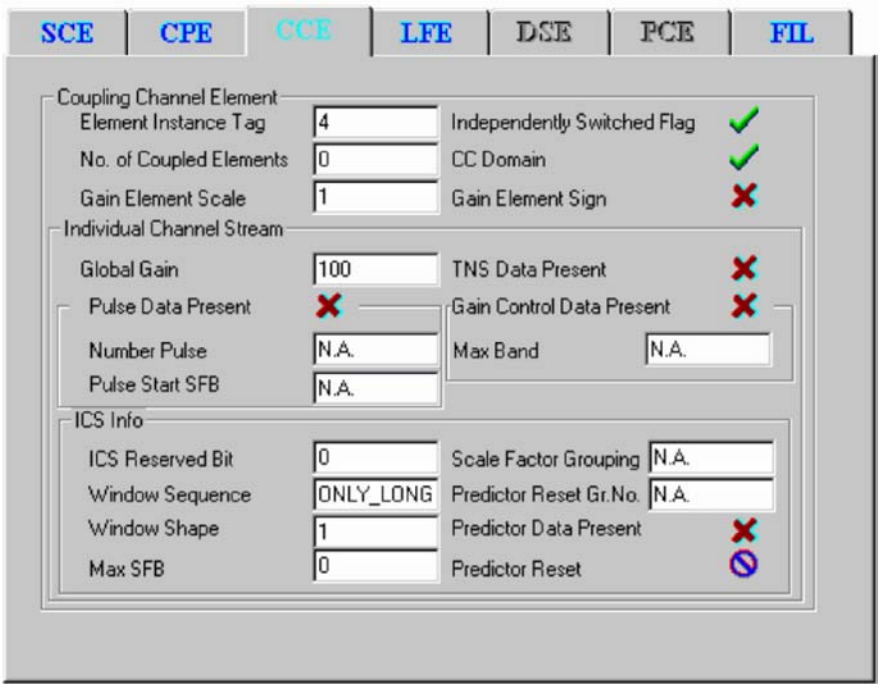


Figure 5-5: Coupling channel element information

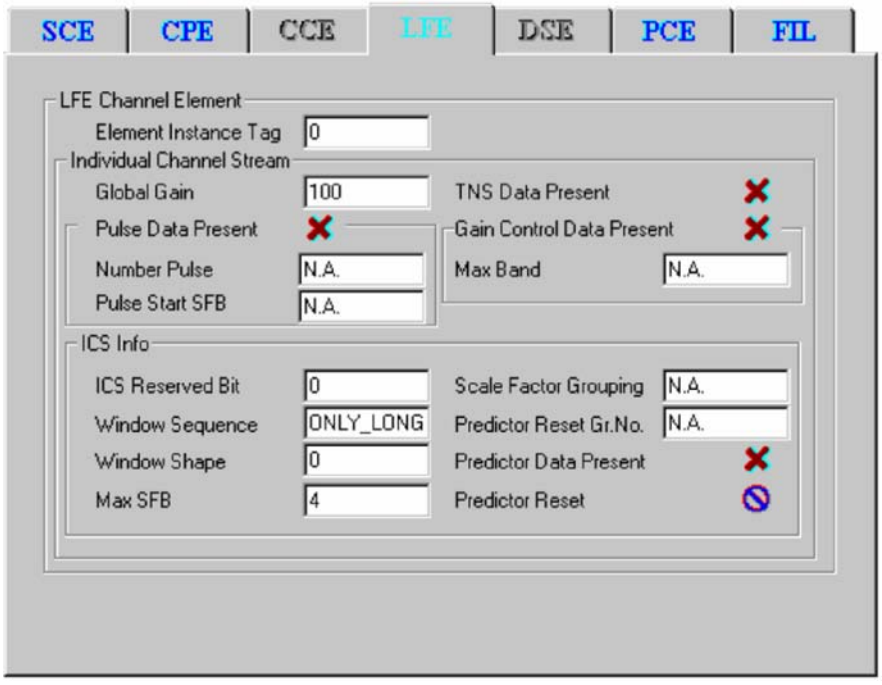


Figure 5-6: Low frequency element channel information

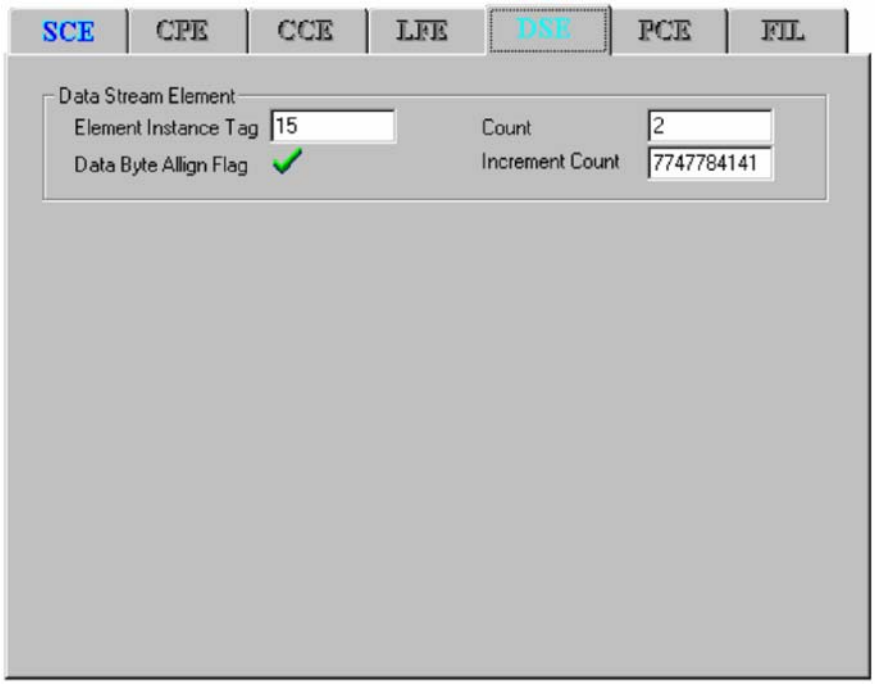


Figure 5-7: Data stream element information

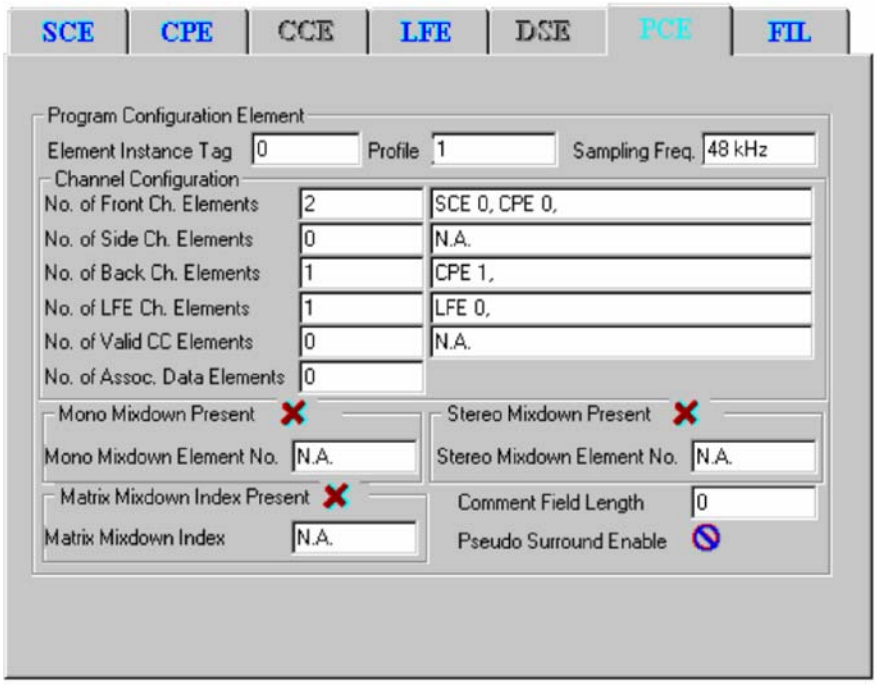


Figure 5-8: Program configuration element information

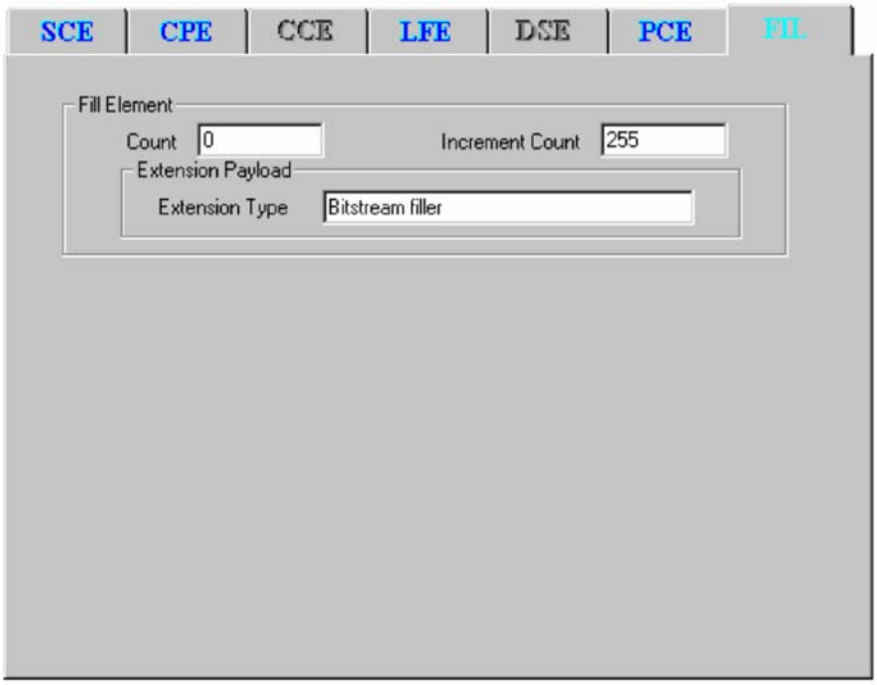


Figure 5- 9: Fill element information

The ‘Channels’ tab (Figure 5-10) displays the configuration of the coded channels. The physical location of the speakers corresponding to the channels coded in the stream for standard and non-standard configurations can be displayed.

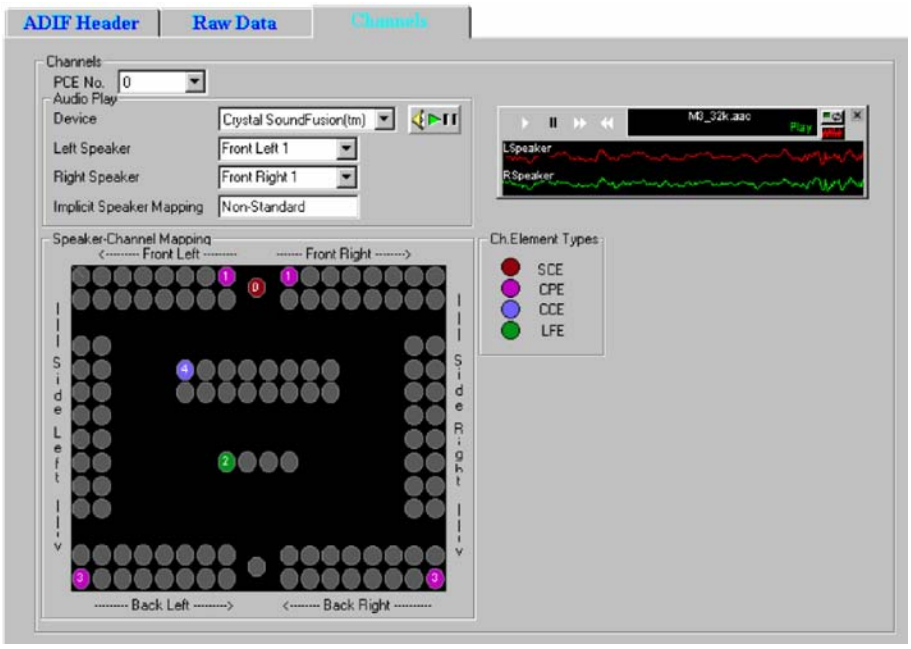


Figure 5-10: ADIF channels (non-standard) information

The syntactic element type corresponding to each speaker in the Speaker-Channel Mapping is denoted by a color-code scheme, the legend for which is given in the Ch.Element Types box. The number appearing in the color spots denotes the EIT (element instance tag) of that syntactic element.

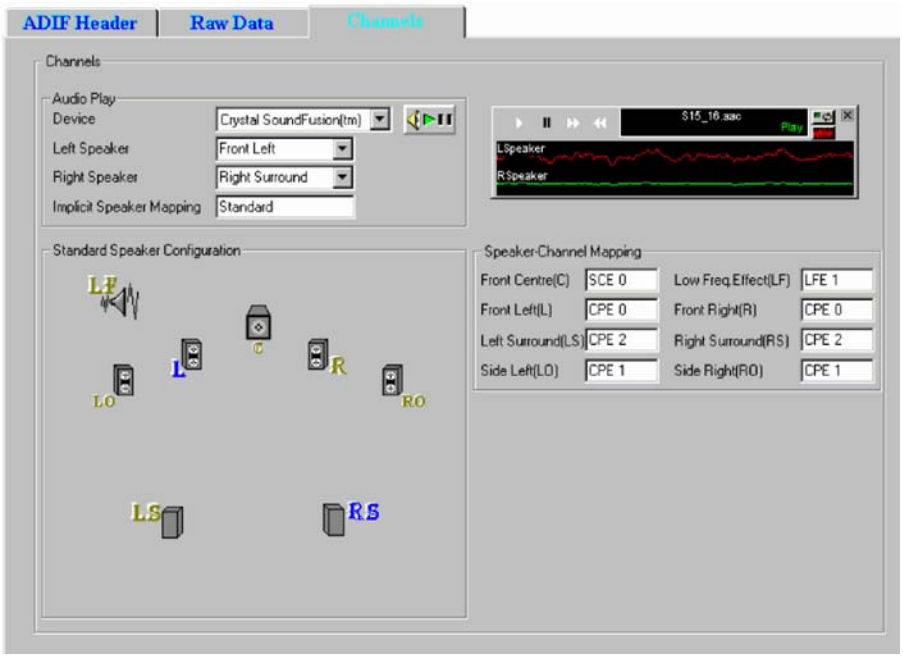


Figure 5-11: ADIF channels (standard) information

ADTS Stream Forms

The analyzed information regarding the input ADTS stream is displayed by means of a property sheet containing three tabs.

The ‘ADTS Header’ tab (Figure 5–12) displays the fields of the header, while the ‘Raw Data’ tab displays the fields in each raw data block and the ‘Channels’ tab displays the configuration of the coded channels. The content of the ‘Raw Data’ and ‘Channels’ tabs are identical to that in the ADIF stream.

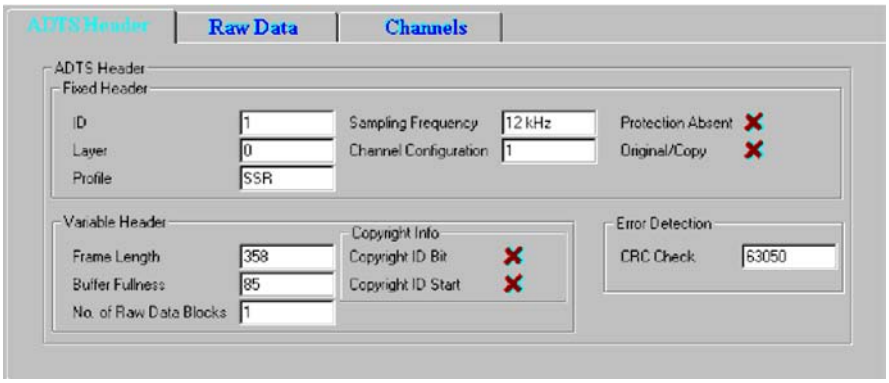


Figure 5- 12: ADTS header information

Closed Caption Analysis

Closed captions are captions that are hidden in the video signal, invisible without a special decoder. The place they are hidden is called line 21 of the vertical blanking interval (VBI).

ES Analyzer allows closed caption data to be analyzed and inspected.

The two options are:

- CCA Standalone (Player + CC-EIA608 + CC-EI708 analysis)
- Full Elementary Stream Analyzer + CC-EIA608 + CC-EI708 analysis

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***NOTE**. No special installation process is required. The options are dongle protected/enabled.*

The Stand-Alone option has full Closed Caption functionality, but other ES Analyzer functions are disabled.

XDS analysis is currently disabled. Extended Data Services is a supplementary data stream existing in Line 21, Field 2. It is used to provide additional data (primarily content advisory information) on the program being aired (Reference: EIA-744).

Enabling Closed Caption Analysis

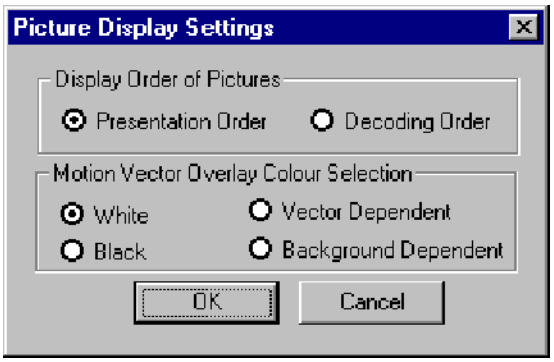
1. Open a stream containing Closed Captions.
2. Expand the navigation tree and open either a VES or a GOP node.
3. Enable Closed Caption Analysis in the Settings menu. A check mark next to the option indicates that Closed Caption Analysis is enabled.

***NOTE**. By default, Closed Caption Analysis is enabled. It is recommended that it be only enabled when required; disabling it will improve the speed of picture analysis processing.*

However, disabling and enabling the Closed Caption Analysis feature should only be done when a stream is first opened, not during analysis. Opening the feature during analysis may result in improper analysis.

When Closed Caption Analysis is enabled, the Closed Caption Display tab will be visible in the Slice and MB GOP tab.

4. Ensure that the Picture Display Settings (Settings > Picture Display…) are as shown in the following screenshot:



- Display Order of Pictures > Presentation Order
- Motion Vector Overlay Colour Selection > White

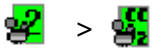
Selecting Closed Caption Analysis Standard

Two primary forms of Closed Caption Analysis are offered: CC-EIA608 and CC-EIA708. CC-EIA746 support is also supported in the EIA608 mode.

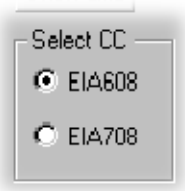
The selection of CC-EIA608 or CC-EIA708 is made from the Closed Caption Display tab available in the Slice and MB GOP tab.

***NOTE**. Whichever standard is selected, no closed caption content will be displayed until the file has been at least partially analyzed. To start analyzing the stream, select the GOP And Picture tab and press the Go button.*

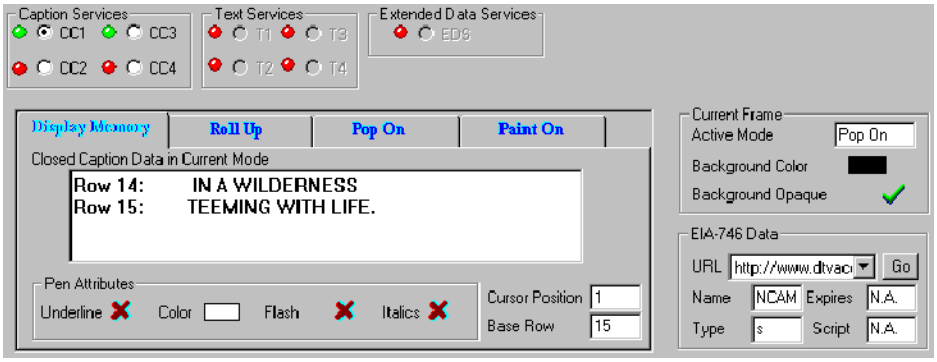
A sign that closed caption content has been detected during analysis is that the Video icon in the navigation tree changes to include a CC symbol:



CC-EIA608 Support



The following dialog box is displayed below the picture display (in the Closed Caption Display tab) when CC-EIA608 Closed Caption Analysis is enabled:



At the top of the display, the LED icons indicate that closed caption data has been received in the Field and Services sections; green indicates that data has been received.

If data has been received for the current GOP it should be displayed in the Display Memory tab and on the picture display:

The remaining tabs (Roll Up, Pop On and Paint On) display various parameters defining the manner in which the captions will be displayed.

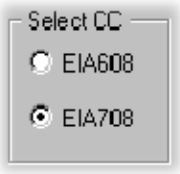
CC–EIA746 Support

Associated with CC-EIA608 is CC-EIA746 which supports the transmission of URLs (Uniform Resource Locators) within the closed caption data.

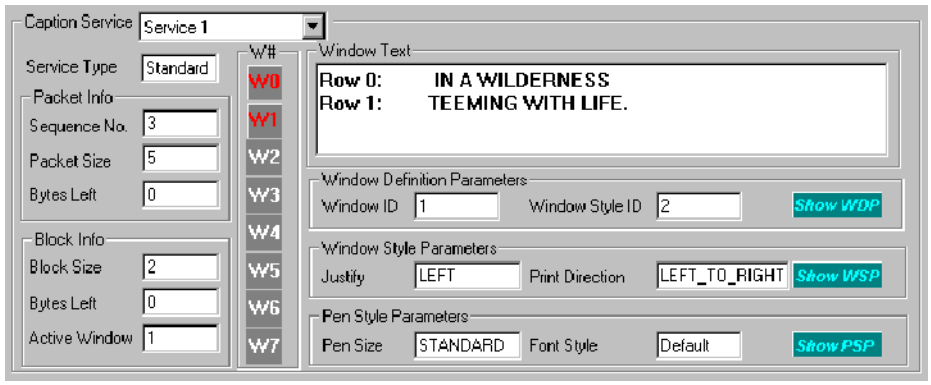
The URLs transmitted in the T2 closed caption service are parsed, decoded and displayed in the EIA-746 Data view.

- The attributes shown apply to the URL selected from the drop-down list.
- The selected URL is fetched and displayed on the default Web browser installed on the system.

CC-EIA708 Support



The following dialog box is displayed below the picture display (in the Closed Caption Display tab) when CC-EIA708 Closed Caption Analysis is enabled:



Details of the fields in the Closed Caption Analysis window are as follows:

Caption Service The service whose details are to be displayed can be selected from the drop-down list.

Packet Info

Sequence No.	The sequence number of the packet from which the current service block has been extracted (for example, Service 1, Service 2, etc).
Packet Size	The packet size that has been coded in the packet header.
Bytes Left	The number of bytes still to be received.

Block Info

Block size	The size of the service block.
Bytes Left	The number of bytes still to be received.
Active Window	The Window ID which is currently the active window.

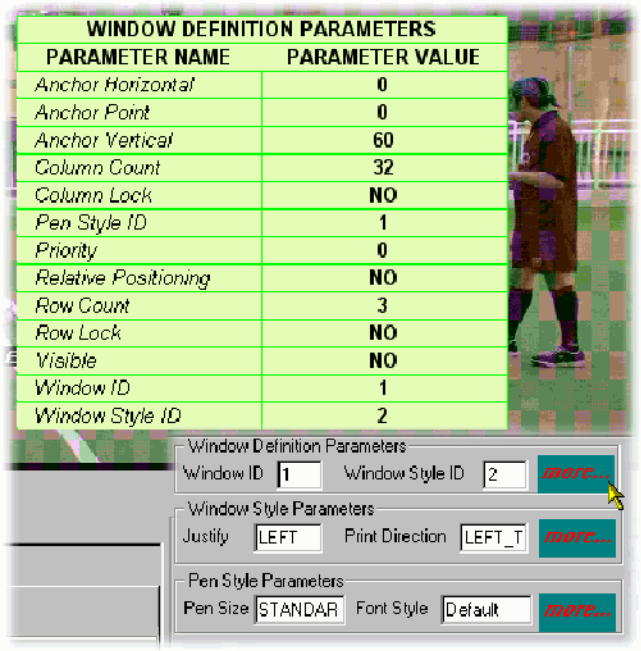
Window Identity

W#	The buttons in red in the W# column indicated the defined windows in the received service. The parameters to the right of this column depend on the selection made here.

Window Text The text shown in the current window.

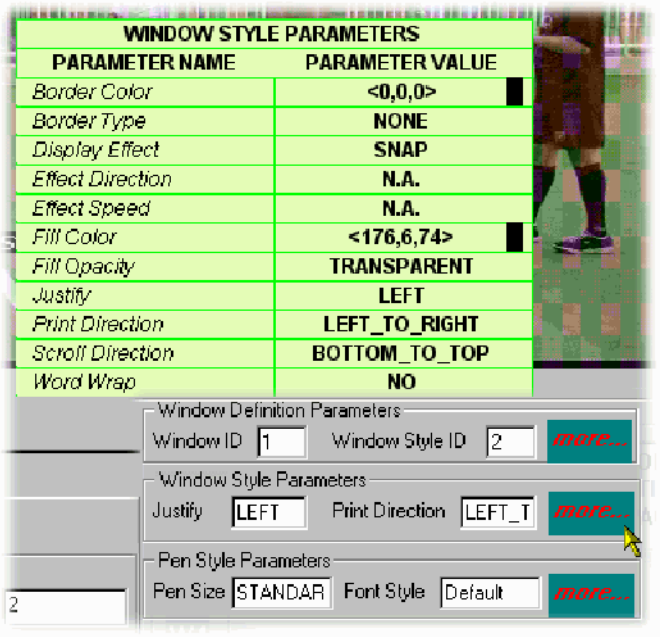
Window Definition Parameters

By placing the cursor over the more… field all the parameters related to the window definition can be viewed.



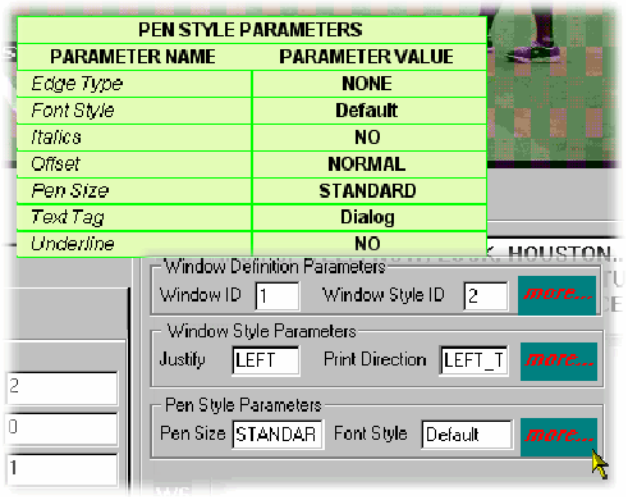
Window Style Parameters

By placing the cursor over the more… field all the parameters related to the window styles can be viewed.



Pen Style Parameters

By placing the cursor over the more… field all the parameters related to the pen styles can be viewed.

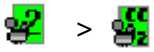


Dumping Closed Caption Statistics

Closed Caption Analysis statistics can be written to file for each standard (EIA608 and EIA708).

***NOTE**. Regardless of which standard is selected, no closed caption statistics can be dumped until the file has been at least partially analyzed. To start analyzing the stream, select the GOP And Picture tab and press the Go button.*

A sign that closed caption content has been detected during analysis is that the Video icon in the navigation tree changes to include a CC symbol:



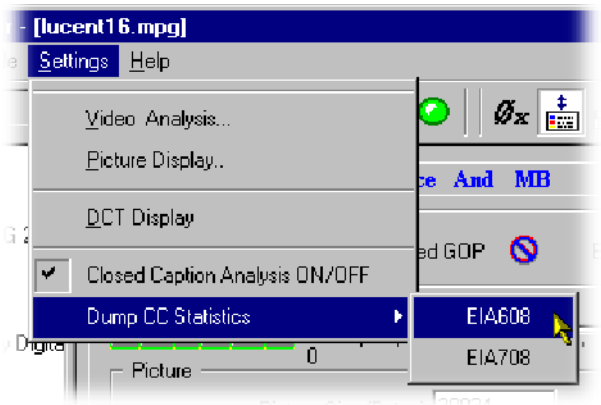
The sequence of actions required for a dump of statistics to be successful is as follows:

1. The Dump CC Statistics option in the Settings menu will only become available when analysis (or partial analysis) has established that Closed Caption data is carried in the stream.
2. A standard must be selected from the Dump CC Statistics option sub-menu, for example, EIA608.
3. A destination file must be specified for the statistics dump.
4. Further analysis must be carried out to provide data for the statistics dump.

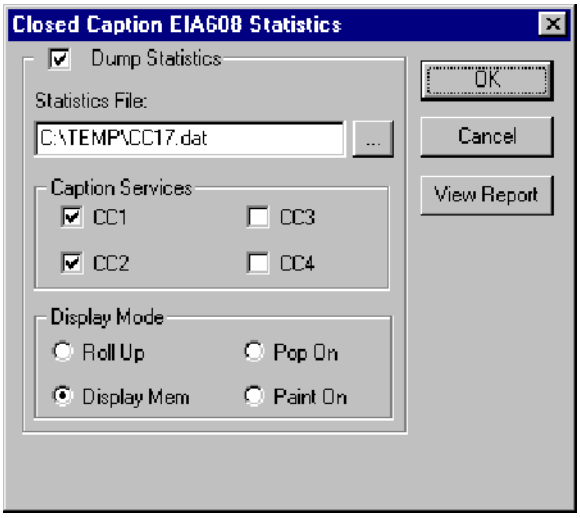
The following paragraphs describe the setup required for each standard; however, the previous steps must be adhered to for the dump to be successful.

EIA608 Closed Caption Statistics Dump

1. Select the EIA608 option from the Dump CC Statistics sub-menu.



2. Enable Dump Statistics.

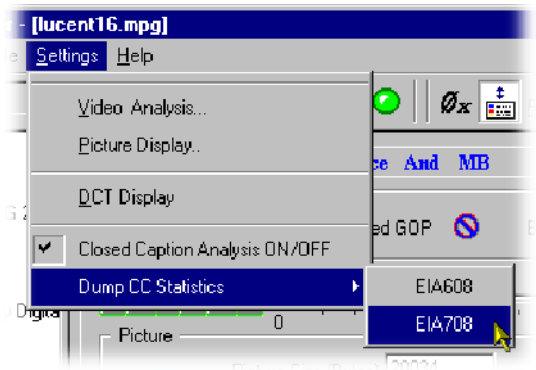


3. Identify a destination file in the Statistics File: field.
4. Enable the parameters to be dumped.
5. Select OK.

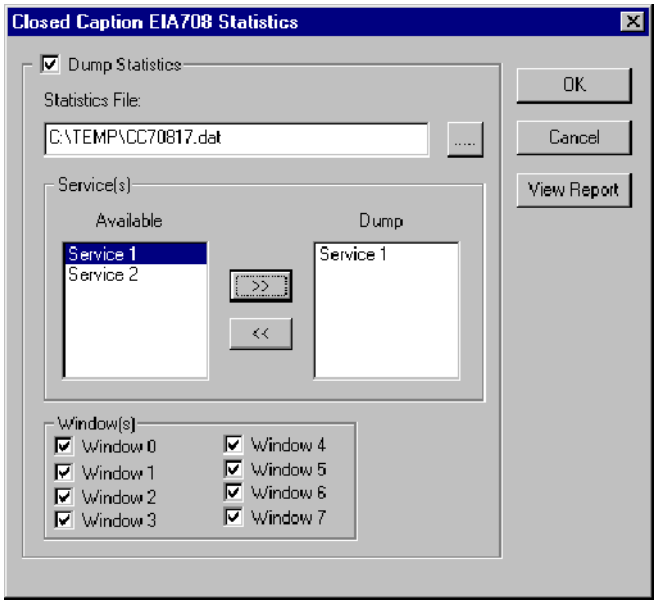
Existing reports (reports that you set up) can be viewed by selecting View Report.

EIA708 Closed Caption Statistics Dump

1. Select the EIA708 option from the Dump CC Statistics submenu.



2. Enable Dump Statistics.



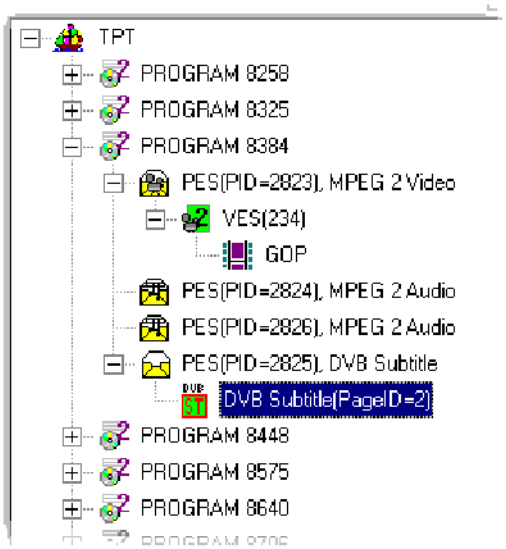
3. Identify a destination file in the Statistics File: field.
4. Enable the parameters to be dumped.
5. Select OK.

Existing reports (that is, reports previously set up) can be viewed by selecting View Report.

DVB Subtitle Stream Analysis

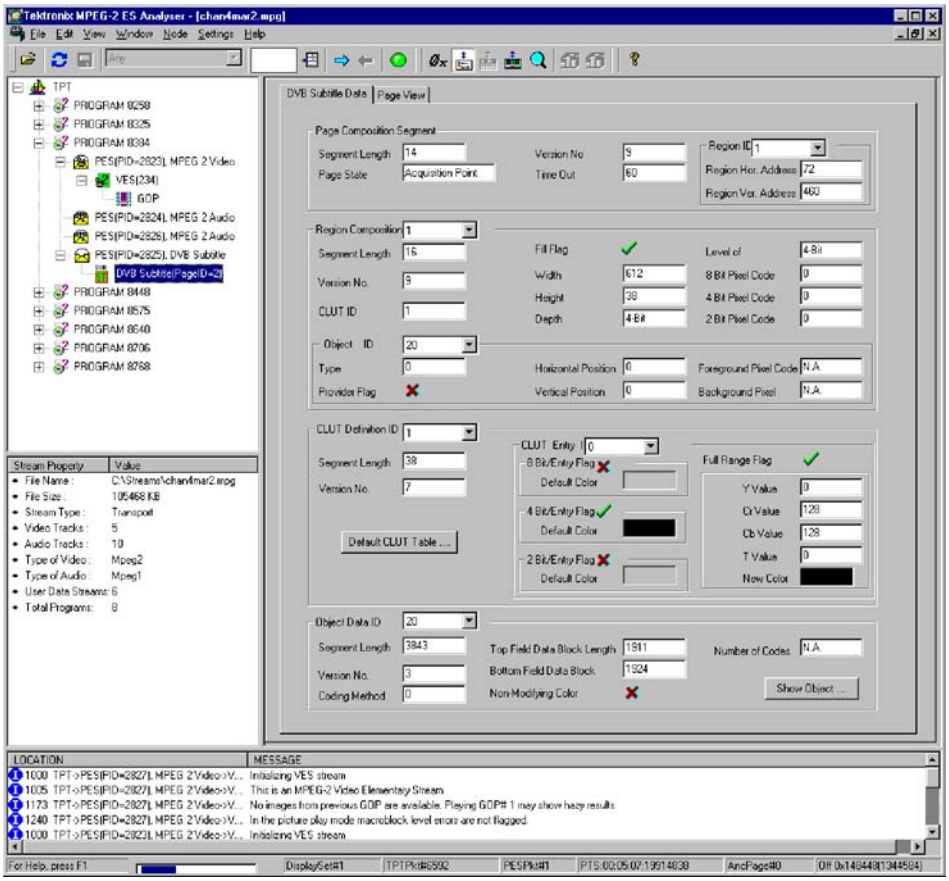
DVB Subtitling provides a means of conveying region-based bit-mapped graphics as MPEG-2 packetized elementary streams (PES). The bit-mapped pixel images are run-length encoded and transmitted with color look-up tables (CLUT) to a decoder where the stream is decoded and the subtitle image rendered with the on-screen display.

When a DVB Subtitle node is revealed and highlighted, the screen shown below is displayed:



***NOTE**. Some streams may show subtitle nodes from which the Page View (described below) cannot display any subtitles.*

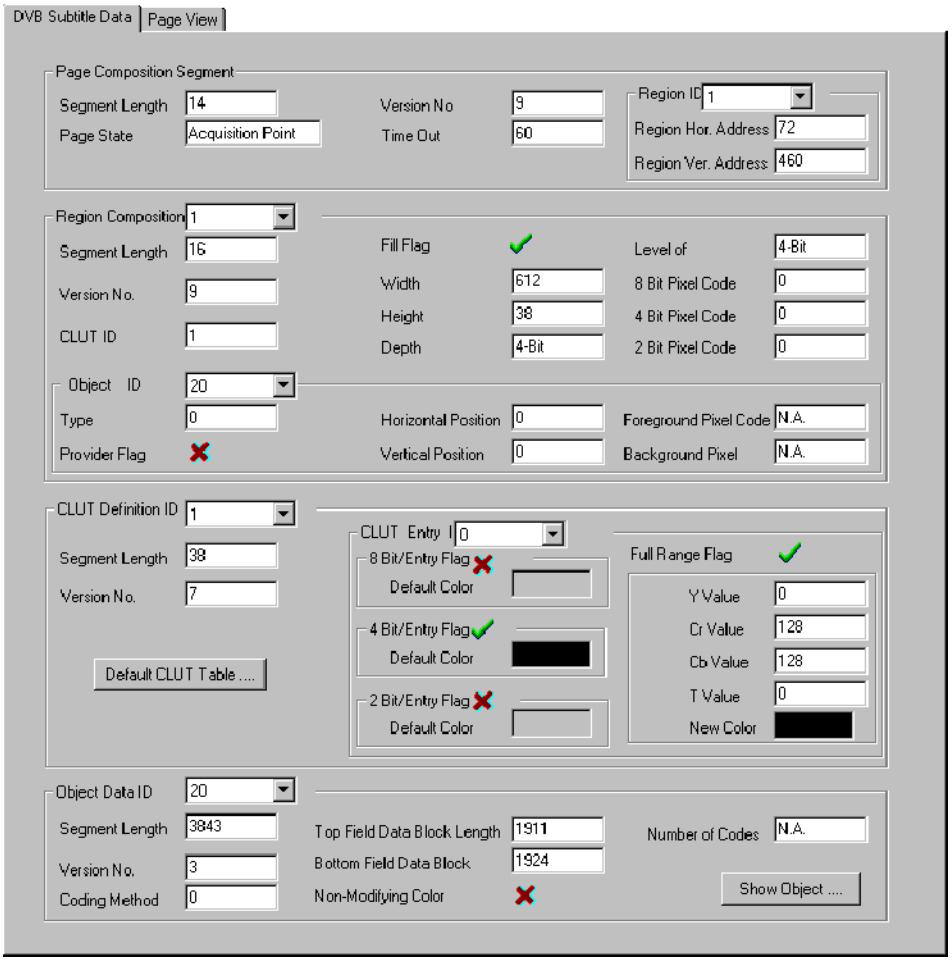
This is not an error, it is because the stream is too short to carry the requisite data. If possible, record a longer section of the stream and retry the analysis.



The working area contains two tabs: DVB Subtitle Data and Page View.

DVB Subtitle Data Tab

The DVB Subtitle Data tab displays the fields associated with the current display. Access to two areas of detail is provided by pressing the Default CLUT Table… and the Show Object… buttons.



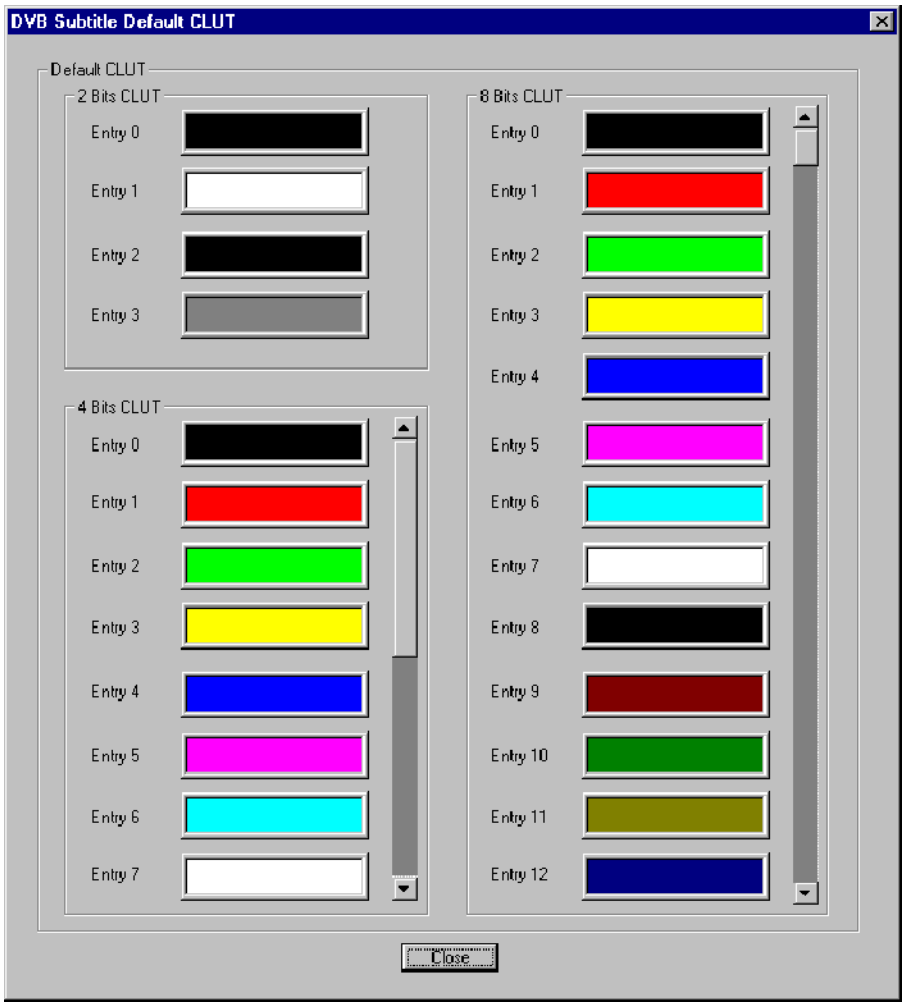
Object View

The Object View displays a decoded bitmap of the selected object rendered on a blank screen (that is, with no underlying picture). The fields at the top of the dialog box, provide the user with the options of changing the decoder type (2-bit, 4-bit or 8-bit), the background color, and the CLUT identity. As described in the standard, the CLUT is attached to the region, not the object; therefore, the user can see the bitmap using all of the available CLUTs.

The Object view is displayed by selecting the Show Object… button on the DVB Subtitle Data tab.

CLUT View

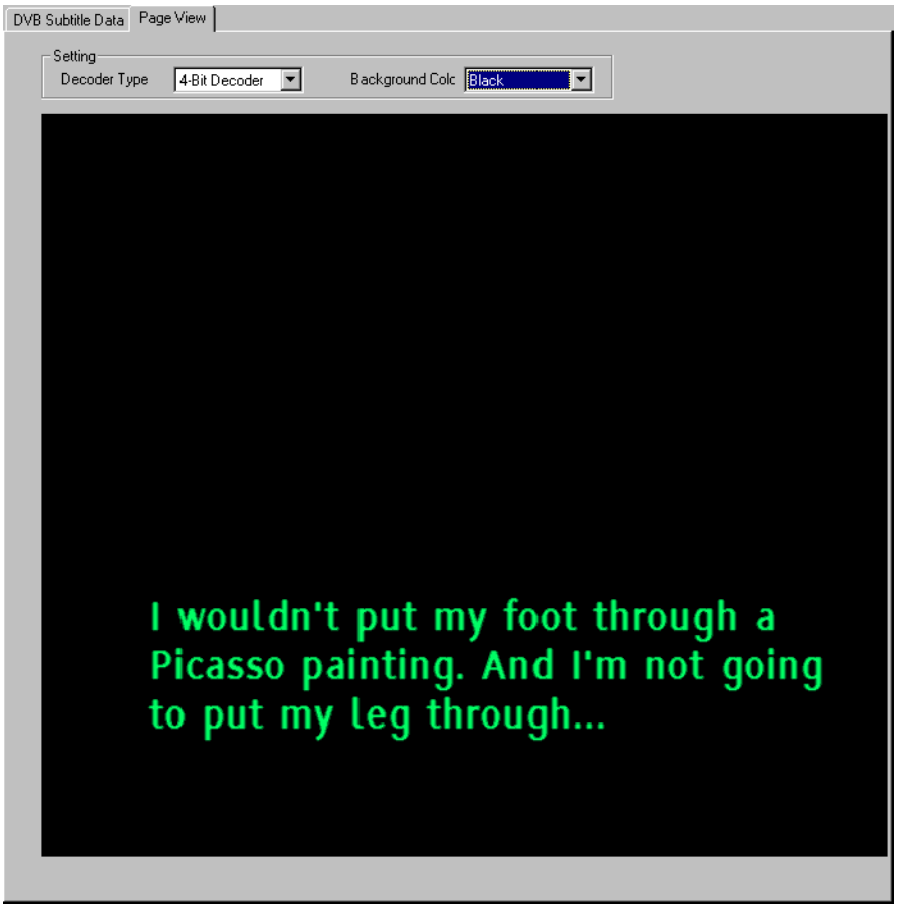
The Object view is displayed by selecting the Default CLUT table… button on the DVB Subtitle Data tab.



***NOTE**. Subtitles in the UK are colored in a limited set, (red, cyan, green, yellow, white), one for each of four speakers/actors and white for additional speakers/actors.*

Page View Tab

On the Page view tab, the regions listed in the Page Composition Segment area of the DVB Subtitle Data tab are rendered on a blank screen (size 720(H) x 576(W) pixels). The regions and objects are rendered at their actual locations on the blank screen. The user can select the Decoder Type and Background Color from the drop-down lists.



***NOTE**. Background color is not carried in the broadcast. The user can select a suitable color.*

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